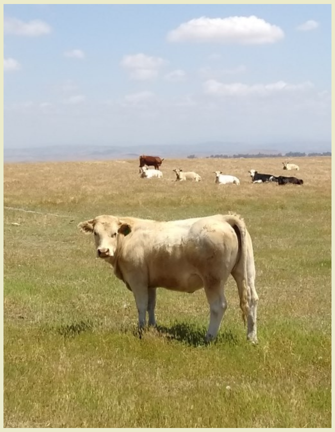
RANGE BULLETIN

Livestock & Natural Resources Newsletter

In this issue:



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News Briefs

Rangeland Weed Management Workshop

Save the date! The Rangeland Weed Workshop will be held on Saturday, May 11, at the McKenzie Preserve (Fresno County).

Presentation topics will include:
- Field Weed ID
- Herbicide Options for Rangelands
- Targeted Grazing
- And more!

Visit **https://ucanr.edu/rangeweeds2019** to register. Check out the agenda on the last page of this newsletter. **3.5 hours of DPR credits have been approved**.

In the works - Oak Research

UCCE livestock and range advisors in the San Joaquin Valley and Central Coast are developing a new research project to examine oak mortality and oak populations. We will soon be setting up research sites on local ranches. If you are interested in hosting a research site, let us know! Email or call Rebecca: rkozeran@ucanr.edu or (559) 241-6564.

UCCE | University *of* California Agriculture and Natural Resources | Cooperative Extension

Methods to reduce the risk of *E.coli* O157:H7 shedding in cattle

By Gaby Maier, DVM, MPVM, PhD

Background

E. coli O157:H7 belongs to the Shiga toxin-producing *E. coli* (STEC) and is a bacterium that often colonizes the guts of cattle, although many animal species harbor it in their digestive tract. There are other STECs besides *E. coli* O157:H7, although much less studied, and the terms are used interchangeably here. This pathogen can cause serious disease in people, especially in the elderly, children or immune-compromised. Cattle shedding STEC, on the other hand, do not show signs of disease because they lack the receptor that binds the toxin produced by the pathogen. People get exposed through various routes, such as direct contact with animals or infected persons or through water sources, but the most important route is via contaminated food [1]. Some of the foods most commonly associated with *E. coli* infections are ground beef as well as vegetables, such as Romaine lettuce, which was implicated in one of the most recent outbreaks in the US [2]. Interventions at the slaughter plant and consumer education about properly cooking meat have led to a decrease in the number of cases of human STEC infections over the past 20 years [3]. Nevertheless, there is some concern that cattle may be a possible source of STEC contamination of vegetable crops [4]. Strategies to prevent fecal shedding of STEC in live cattle is therefore desirable to complement food safety measures at the slaughter plant and during food preparation. The pathogen lives both in the environment as well as in the host and cattle shed STEC at different rates depending on factors such as ambient temperature or diet [5]. So-called super-shedders, i.e. cattle shedding at least 1000 colony forming units (CFU) / g of feces, play an important role in transmission among cattle, but the mechanisms that lead to super-shedding are not well understood [6]. Possible targets for reduction of STEC shedding are thus the environment and the guts of cattle. Vaccines targeted at *E. coli* O157:H7 have been explored as a means of reducing the survival and shedding of STEC from cattle guts. Let's look at the different targets in more detail.

External environment:

Management factors are important for biosecurity and animal health and may help reduce the burden of STEC, however, they will not eliminate *E. coli* O157:H7 from the environment.

This article continues ▶

E. coli *cont'd*

Season: STEC burden is higher in **warmer summer months** [7, 8], likely because conditions are more favorable for STEC replication in the environment. Season is one of the most reliable predictors for STEC shedding across studies and efforts to minimize STEC shedding from cattle should be intensified during the warmer months.

Stress: Weaning and transport have been associated with increased STEC shedding [9, 10] and there is evidence that the stress hormone norepinephrine stimulates *E. coli* O157 growth [11]. Low-stress handling may be helpful in reducing STEC shedding.

Manure: Super-shedders are thought to be the biggest contributors to pen contamination and transmission. 20% of *E. coli* O157:H7 shedding cattle are responsible for 80% of infections in cattle [12]. Unfortunately, we still don't have the means to easily identify and mitigate super-shedders. However, reducing manure as a source of transmission through pen cleaning and proper stocking density may help reduce overall STEC shedding.

Water troughs: *E. coli* O157:H7 is commonly found in pen water troughs and survives in this environment, especially at colder water temperatures [13]. Addition of disinfectants such as chlorine at 2 to 5 ppm (2 to 5 ml chlorine per 1000 L of water), 0.1% caprylic acid or trans cinnamaldehyde have been effective in reducing or inactivating *E. coli* O157:H7, but palatability and water intake by cattle may be impaired [14, 15]. In addition, organic matter such as algae and feces inactivate disinfectants quickly. Overall, water trough management, while important for cattle health and welfare, has not been identified as an efficient means to reduce STEC shedding.

Other species: Rodents, insects, birds (starlings, cowbirds, egrets, wild geese), pigs, sheep and deer have all been shown to carry STEC or to increase the risk of cattle shedding STEC if found in cattle proximity [16-21]. While reducing contact of these species with cattle can have many benefits, the direct effect on STEC shedding is probably limited [22].

Concentration and Prevalence of *Escherichia coli* O157 in Cattle Feces at Slaughter
F. Omisakin,[1] M. MacRae,[2] I. D. Ogden,[2] and N. J. C. Strachan[1*]

Handling May Cause Increased Shedding of *Escherichia coli* and Total Coliforms in Pigs
SCOT E. DOWD,[1] TODD R. CALLAWAY,[2] and JULIE MORROW-TESCH[1]

Escherichia coli O157:H7 in Microbial Flora of Sheep
INDIRA T. KUDVA,[1] PATRICK G. HATFIELD,[2] AND CAROLYN J. HOVDE[1*]

Many species shed E. coli, including wildlife and other livestock species.

Internal environment:

Feeds that are associated with **increased** STEC shedding:

Distillers grains: multiple studies have shown increased *E. coli* O157 shedding with feeding brewer's grains [23], dried distiller's grains [24] or wet distiller's grains [25].

This article continues ►

E. coli *cont'd*

The suggested mechanism is that distiller's grains are highly rumen digestible, leading to less starch passing to the hindgut and resulting in a higher fecal pH, which may be more hospitable to *E. coli* O157 [26]. However, the relationship between hindgut starch fermentation, pH and STEC survival is more complex than this and study results with other feed stuffs show different relationships [27].

Fasting: fasting leads to a decrease in the amount of volatile fatty acids in the ruminant digestive tract and has been associated with an increase in STEC shedding [22].

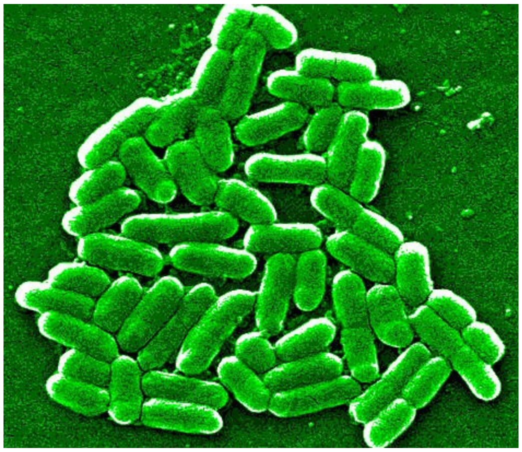
Feeds that are associated with **decreased** STEC shedding:

Orange peel: when fed at 10% dry matter to sheep in a mixture with dried orange pellets, fresh orange peel reduced *E. coli* O157:H7 in the intestinal tract of experimentally infected sheep [28].

Cottonseed: Feeding whole cottonseed was associated with decreased shedding of *E. coli* O157:H7 in dairy calves [29].

Tasco: a brown seaweed (*Ascophyllum nodosum*) feed additive marketed to improve intestinal health has been shown to reduce *E. coli* O157:H7 in feces by 11% [30]. This product is available in the US through Tasco's distributor Nutrablend.

Essential oils: citrus oils have shown antimicrobial activity against *E. coli* O157:H7 in vitro, but controlled studies in live animals are still lacking [27].


E. coli *O157 image © Public Health Wales*

Probiotics

Probiotics are beneficial bacteria such as *Lactobacillus acidophilus* or *Propionibacterium freudenreichii.* These bacteria work by crowding out harmful bacteria and/or promoting host immunity. Studies have shown that products containing certain probiotics can successfully reduce *E. coli* O157:H7 shedding in cattle. Bovamine Defend® is a product that has performed well in multiple studies at reducing the risk of shedding [31, 32].

Vaccines

There is currently one vaccine conditionally licensed in the U.S. named Escherichia Coli Bacterial Extract vaccine with SRP® that is targeted against *E. coli* O157. It is marketed by Zoetis and available through veterinarians. It is labelled for vaccination of healthy cattle 5 months or older. Three doses are recommended, however the duration of immunity is unknown and there is a 60 day slaughter withdrawal period. The SRP in the vaccine's name stands for Siderophore Receptors and Porins, which are transport proteins in the *E. coli* cell surface that are necessary for iron transport into the bacterial cell. The vaccine elicits an antibody response against bacterial SRP proteins. In a field trial, cattle that received three doses of vaccine were 84.7% less likely to shed STEC, and those vaccinated that did shed had a 98% reduction in fecal bacterial concentration compared to a placebo group [33].

This article continues ▶

E. coli *cont'd*

In a second study, where only 2 doses were given, overall shedding was reduced by 53% and the number of high shedders (shedding more than 10,000 CFU/g feces) was reduced by 77% [34]. Unlike in the first study, the second study saw a small reduction in average daily gain by 2.7% in vaccinated animals, which was contributed to the additional processing when giving the booster injection compared to control animals. In the first study all animals received three injections, either vaccine or placebo.

Vaccines for *E. coli* O157:H7 are not intended to improve the well-being or performance of cattle as *E. coli* O157:H7 is considered a commensal in cattle, not causing disease. So far, the cattle industry has shown little interest for the vaccine, because there is no perceived marketable benefit. It is also important to understand that while they seem to reduce shedding, *E. coli* O157:H7 vaccines are unlikely to eliminate all shedding of STEC from cattle.

Another point to ponder is that any of the prevention measures outlined may become futile from a meat safety standpoint, if treated cattle are mixed with untreated cattle during transport to slaughter through the spread of contaminated feces on hides [6].

Future possibilities

The addition of sodium chlorate to cattle feed or drinking water has shown promising results in *E. coli* O157:H7 reduction but its use in food producing animals is still under review by the FDA [35]. Bacteriophages are viruses that target bacteria and are already in use for reduction of *E. coli* on cattle hides at the slaughter plant. Studies in live animals have shown that phages can reduce *E. coli* O157:H7 shedding in ruminants but large-scale therapy is thought to be difficult to implement [36, 37]. Other bacterial targets for vaccines are being investigated.

Summary

E. coli O157:H7 is shed by many healthy cattle and does not cause disease in cattle. However, it is a pathogen for people and can lead to serious disease and even death if consumed. No measure will be able to completely eliminate shedding from cattle, but reduction is possible through management, nutrition or vaccination. The decision to apply any of the measures highlighted should be based on feasibility and a cost/benefit analysis in discussion with a nutritionist and/or veterinarian.

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E. coli *cont'd*

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If you would like to know more about veterinary research happening at UC Davis, visit Specialist Gaby Maier's website at https://www.vetmed.ucdavis.edu/faculty-directory?fid=25131

How many ground squirrels does it take to equal one AUM?

By Julie Finzel, UCCE Livestock Advisor, Kern County

First, let me define an AUM. An AUM, or an Animal Unit Month, is the equivalent of the amount of feed needed to support one cow, with a calf, for one month. The cow is generally assumed to be 1,000 pounds. Most cows are larger than that these days, but the calculations can be adjusted for any weight of animal. For simplicity in this case, I will use a 1,000 pound cow. The amount of feed a cow consumes each day varies throughout the year and is influenced by forage availability, her physiological requirements, and more. In this case, we will assume the cow is eating 2% of her body weight for one month.

1,000 pound cow x 0.02 (% of body weight) = 20 lbs of forage consumed each day
20lbs of forage/day x 30 days = 600 lbs of forage/month

So one AUM is equal to 600 pounds of forage. Now we need to know how much a ground squirrel eats each day. I reviewed a couple of journal articles to determine this and the estimates range from 15 grams per day up to 50 grams per day. I calculated daily ground squirrel forage consumption at three levels: 15 grams/day, 30 grams/day, and 50 grams/day. One pound equals about 453 grams.

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Ground Squirrels cont'd

To keep the calculations simple, I'm going to round down and say that one pound equals 450 grams.

15 grams/day x 30 days = 450 grams/month 450 grams/450 grams = 1 pound
30 grams/day x 30 days = 900 grams/month 900 grams/450 grams = 2 pounds
50 grams/day x 30 days = 1500 grams/month 1500 grams/450 grams = 3.3 pounds

According to the calculations above, a ground squirrel could eat anywhere from 1 to 3.3 pounds of forage each month. I found an estimate in one of the articles I read that 200 ground squirrels eat as much as one 1,000 pound steer. Working off of that estimate, and using the numbers above, we can test that theory.

1 lb of forage/month/squirrel x 200 squirrels
= 200 pounds of forage/month

2 lbs of forage/month/squirrel x 200 squirrels
= 400 pounds of forage/month

3.3 lbs of forage/month/squirrel x 200 squirrels
= 660 pounds of forage/month

As you can see from the numbers above, on the higher end of the estimate, 200 squirrels can consume as much as (or slightly more than) one AU in a month.

On the lower end of the estimate it would actually take 600 squirrels to consume as much as one cow does in a month. Just like cows, a ground squirrel's forage requirements change throughout the year based on their physiological needs.

Both of the articles I read pointed out that the highest competition between cows and squirrels for forage resources occurs in early winter, before rapid spring growth. In other times of the year, squirrels are either dormant (winter), there is an abundance of feed, or squirrels are consuming different types of forage than cows.

One criticism of both of the articles is that neither accounted for the forage destroyed by trampling burrowing, etc. of the squirrels. One of the citations in the literature review of Howard, et al., was that 6 male ground squirrels confined to a half acre enclosure decreased potential forage yield by 529 pounds. That estimate brings to mind another question, what would happen if 6 teenage boys were confined to a half acre for a month? Eek!

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Virulent Newcastle Disease Update

Since May 2018, an outbreak of virulent New-castle disease (VND) has had a devastating impact on backyard bird populations in four Southern California counties: Los Angeles, Riverside, San Bernardino, and Ventura. The virus has also been found in four commercial facilities in Riverside County and two in San Bernardino County. As a result, nearly one million backyard and commercial birds have been euthanized.

VND is a highly contagious respiratory virus in poultry that is nearly always fatal. The only way to stop the spread of the virus and eradicate the disease is to euthanize infected birds and all birds within highly infected areas. The primary way in which the disease spreads is by seemingly healthy birds being moved.

Clinical signs of VND include: sudden death and increased death loss in the flock, sneezing, gasping for air, nasal discharge, coughing, greenish/watery diarrhea, decreased activity, tremors, drooping wings, twisting of the head and neck, circling, complete stiffness, and swelling around the eyes and neck. For more information, visit bit.ly/cdfa-vnd.

To support disease containment and eradication efforts, the CA State Veterinarian is requiring that all poultry exhibitions that include birds from high-risk counties (Los Angeles, Riverside, San Bernardino, and Ventura) be cancelled.

An exhibition is an assembly of birds (including but not limited to poultry) brought to the assembly location for pur-poses that include public display for any duration. These can be auctions, shops, pet marts, cock fights, petting zoos, or more.

For more information about movement restrictions, biosecurity, and testing requirements, or **to report an unusual number of sick/dead birds, call:** **Sick Bird Hotline 866-922-BIRD (2473)**

—Dr. Annette Jones, CA State Veterinarian

For more information about VND and poultry health, visit

vND resources in English on UCCE poultry website

vND resources in Spanish on UCCE poultry website

Poultry Ponderings (UCCE quarterly newsletter; winter 2019 and fall 2018 editions have relevant articles)

or contact UCCE Poultry Specialist, Dr. Maurice Pitesky, at mepitesky@ucdavis.edu or **530-752-3215.**

Rangeland Weed Management Workshop

Ruth McKenzie Table Mountain Preserve
22477 Auberry Rd, Clovis, CA

Saturday, May 11, 2019
9 am to 2 pm

9:00-9:30am	Intro to McKenzie Preserve and management program, hike to weedy site *Billy Freeman, SFC*
9:30-10:15am	Field weed ID, real-time comparison of weed ID phone apps *Lynn Sosnoskie, UCCE (+ discussion among all speakers/participants)*
10:15-10:45am	Targeted grazing for weed control *Rob Rutherford, Cal Poly Emeritus*
10:45-11:30am	Herbicide options for rangeland weeds *Rick Miller, Corteva AgriScience*
11:30am-12pm	Post-fire weed management *Rebecca Ozeran, UCCE*
12-12:30pm	Lunch
12:30-1:00pm	Proper use and selection of PPE *Julie Finzel, UCCE*
1:00-1:30pm	Spray demonstration *Jason Robbins, Target Specialty Products*
1:30-2:00pm	Roundtable discussion of local weed issues and solutions *All speakers and participants*

To register online or download a mail-in form, visit ucanr.edu/rangeweeds2019
Contact Rebecca at 559-241-6564 or rkozeran@ucanr.edu with any questions.

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