Imperial County Agricultural Briefs

Features **From your Farm Advisors**

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Ecology of Foodborne Pathogens

Mark A. Trent

Health conscious consumers love the convenience of purchasing fresh, bagged salads. Increasing demand for fresh-cut produce has reached an estimated $12 billion in annual sales with $5 billion attributed to cut, packed salad and vegetables. This increased demand also increases the chance for foodborne illnesses to occur. Even though millions of people eat tons of fresh-cut greens and other vegetables each year, a single foodborne outbreak can seriously affect the public's confidence in our food supply and change people's eating habits. The cost of the 2006 *E. coli* outbreak in spinach has exceeded $100 million, with sales declining more than 30 percent.

Just as understanding the ecology of insect pests and the organisms that cause plant diseases is crucial to crop management, knowledge of the life systems of foodborne pathogenic bacteria can help us to produce and provide a safe and healthy product for consumers. In general, bacteria are classified according to their genus and species. For example, *Escherichia coli or E. coli* and *Salmonella enterica* or *S. enterica.* However, because of the diversity among certain species of bacteria it is often necessary to divide the species further into groups known as subspecies, strains, or serovars. For example the genus *Salmonella* consists of two species, *S. enterica* and *S. bongori*, diversity lies in the over 2,000 serovars that comprise *S. enterica*. An example of a serovar is *S. typhi*, which causes systemic infections and typhoid fever. The complete classification for *S. typhi* is: *Salmonella enterica* subsp. *enterica* serovar *typhi*. One reason for subspecies, strains and serovars is that a subspecies of a certain bacterial species may or may not cause disease. Also, many subspecies, serovars or strains of a certain pathogenic bacteria species may cause disease in one host but not in another.

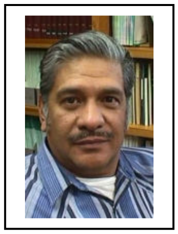
Typically, *E. coli* colonizes the gastrointestinal tract of newborns within hours after birth and is the predominant facultative anaerobe in the humans and other warm-blooded animals' colonic flora. Most strains of *E .coli* are beneficial; humans and other species cannot survive without them. However, some strains have evolved to be pathogenic. Pathogenic *E. coli* have short, hair-like projections or appendages called "fimbriae" on their outer surface that act as a virulence factor by promoting adherence. In their natural environment, pathogenic *E. coli* use these fimbriae to attach themselves to the gut of an animal. When the animal sheds these bacteria through defecation the life of the bacteria outside its host is limited. However, they do have a survival mechanism. If the bacteria come into contact with alternative host such as a living plant it can use its fimbriae to attach, derive nutrients and multiply.

Salmonella bacteria are very common on raw egg shells, in poultry, and red meat; it is also a natural part of the bacterial flora of reptiles and amphibians. In addition to these common habitats for *Salmonella*, contaminated water is one of the major sources for contraction of *Salmonella* illnesses worldwide. Similar to *E. coli, Salmonella* has the ability to attach itself to plants as a survival mechanism.

Anything that comes into contact with fresh produce has the potential to contaminate it. A major source of microbial contamination of fresh produce is indirect or direct contact with feces. Potential sources of fecal contamination include animals, untreated manure used as a soil amendment, water, infected workers, or conditions in the field or packing facility, such as unclean containers and tools used in harvesting and packing.

Prussic Acid Poisoning

Juan N. Guerrero



Cooling temperatures are not conducive to sudangrass growth. Remaining sudangrass fields, not productive at the end of the calendar year, can nevertheless be used for grazing livestock. Both lambs and steers can graze remaining sudangrass fields.

Sudangrass as a pasture crop does, however, have one major potential problem, prussic acid poisoning. Certain plants, such as sudangrass, under certain growing conditions, produce cyanide, which is lethal to livestock. In the rumen the cyanide becomes hydrocyanic acid (HCN), commonly known as prussic acid. When a steer or lamb consumes enough HCN, it generally dies within 15 to 20 minutes without any apparent symptoms. The animal dies asphyxiated, HCN preventing the oxygenation of blood. Often unseen, prior to death the animal has an increased respiration and pulse rate, nervousness, blue color in the mouth, muscle spasms, and finally gasps for air, unable to breathe.

What are the conditions that lead to HCN poisoning? One of the factors that stimulate HCN formation is high levels of N fertilization. Since many irrigated desert sudangrass fields are fertilized with N, the causative factors leading to HCN problems will always be present. Fields to be grazed should not be fertilized after the last hay harvest of the year.

Sudangrass that is less than 18 to 24 inches tall is prone to HCN problems. Cyanide formation is more of a problem in sudangrass during the earlier stages of (re)growth, concentrating in tillers and in upper leaves. The use of sudangrass with 500 ppm or greater of HCN should be avoided. For example; young, growing, dark green, 4 to 5 inch tall sudangrass often has 1000 ppm (or more) HCN.

Drought concentrates cyanide in the sudangrass leaves. After the last sudangrass cutting, fields are not always adequately irrigated, sudangrass growth coming from the water remaining in the soil profile. These smaller water-stressed plants, plants less 24 inches tall, may not grow out of the cyanide accumulation stage and may pose a threat to grazing livestock. As temperatures cool, remember that ***frosted*** sudangrass is ***extremely dangerous*** until it has dried out. In frozen sudangrass leaves, the HCN is released quickly. After a frost on sudangrass, livestock ***MUST BE REMOVED IMMEDIATELY,*** remember that ruminants can die within 15 to 20 minutes on sudangrass with more than 500 ppm of HCN. If freezing temperatures occur during the night and you have cattle or lambs on a sudangrass field, don't wait until the next morning to move them, pen them up IMMEDIATELY at night and then move them the next morning. After a frost, wait for 5 to 7 days of frost-free weather before grazing the frosted sudangrass.

Late sudangrass is a good cheap feed for fall steers and lambs in the Imperial Valley. However, prussic acid poisoning may present some problems that both the grazier and the land owner should be aware of.

Evaluation Insecticides for Egyptian Alfalfa Weevil and Aphid Control In Alfalfa

Eric T. Natwick

A field study was conducted during the spring of 2008 at the UC Desert Research and Extension Center. A stand of alfalfa, VAR. CUF 101, was used for the experiment. Plots were arranged in a randomized complete block design with five replications. Five insecticide treatments were included along with an untreated control. Insecticide treatments and rates are listed in Table 1. Plots measured 13.3 feet by 50 feet and insecticide treatments were applied February 25, 2008, using a broadcast application with a tractor mounted boom. Egyptian alfalfa weevil (EAW) larval populations were measured in each plot with a standard 15-inch diameter insect net consisting of ten, 180^o sweeps. Aphid populations {blue alfalfa aphid (BAA) and pea aphid (PA)} were sampled by recording the number of aphids by species from ten stems per plot. Predators and parasites of weevils and aphid were also counted from sweep samples. Plots were sampled on February 21, 28, March 3, 10, and 17; 4-day pre-treatment (DPT), 3-days after treatment (DAT), 7-DAT, 14-DAT and 21-DAT.

There were no significant differences among plots for EAW larvae in the pre-treatment samples (P = 0.05), Table 1. All insecticide treatments had EAW larval means that were significantly lower than the untreated control for all post treatment sampling dates. At 3-DAT Furadan 4F had significantly fewer EAW larvae than all other insecticide treatments. Although not significantly different from some insecticide treatments at 7 and 14-DAT, Furadan 4F had the lowest EAW larval means on all post treatment sampling dates. By 21 DAT there were no significant differences among insecticide treatments.

There were no significant differences among plots for BAA and PA in the pre-treatment samples (P = 0.05), Tables 2 and 3. All insecticide treatments had BAA means that were significantly lower than the untreated control for sampling dates 3-DAT through 14-DAT with the exception of Entrust + M-Pede 7-DAT. None of the insecticide treatments had BAA means that were significantly lower than the untreated control 21-DAT. None of the insecticide treatments had PA means that were significantly lower than the untreated control 3-DAT and 21-DAT. At 7-DAT, all insecticide treatments had PA means that were significantly lower than the untreated control with the exceptions of Lorsban 4E and Entrust + M-Pede. At 14-DAT, all insecticide treatments had PA means that were significantly lower than the untreated control with the exception of Lorsban 4E. None of the insecticide treatments had PA means that were significantly lower than the untreated control 3-DAT and 21-DAT.

All insecticide treatments had some negative impacts on aphid parasitic wasps (mostly *Diaeretiella spp.*), and predators, such as the sevenspotted lady beetle, (*Coccinella septempunctata* L.), minute pirate bugs (*Orius spp.*), damsel bugs (*Nabis spp.*), and spiders (Tables 4 – 8).

Table 1. Egyptian Alfalfa Weevil Larvae per Sweeps, Holtville, CA, 2008.

Treatment	oz/acre	PT[w]	3 DAT[vx]	7 DAT	14 DAT	21 DAT
Untreated	--------	14.92	1.61 a	15.88 a	17.62 a	6.32 a
Lorsban 4E	32.0	10.34	1.28 b	8.30 b	4.34 bc	2.40 b
Lorsban Advanced	32.0	9.64	1.32 b	8.60 b	5.10 b	2.14 b
Radiant + Dimethoate 267E	8.0 + 16.0	11.84	0.32 c	1.10 c	0.78 d	2.10 b
Entrust 80 + M-Pede	1.25 + 1% v/v	12.78	0.38 c	0.86 c	1.64 cd	0.92 b
Furadan 4F	16.0	14.54	0.04 d	0.02 c	0.01 d	0.74 b
LSD; *P* = 0.05		NS	0.27	4.89	3.18	2.11

Means within columns followed by the same letter are not significantly different.
[v] Log transformed data used for analysis.
[w] Pre-treatment.
[x] Days after treatment.

Table 2. Blue Alfalfa Aphids per Stem, Holtville, CA, 2008.

Treatment	oz/acre	PT[w]	3 DAT[x]	7 DAT	14 DAT	21 DAT
Untreated	--------	46.48	42.20 a	20.88 a	12.40 a	3.06 b
Lorsban 4E	32.0	39.84	4.78 c	3.14 b	4.38 b	5.54 a
Lorsban Advanced	32.0	36.50	7.67 bc	2.12 b	3.58 b	2.00 b
Radiant + Dimethoate 267E	8.0 + 16.0	48.82	5.00 c	1.92 b	3.26 b	1.84 b
Entrust 80 + M-Pede	1.25 + 1% v/v	54.68	19.40 b	13.18 a	5.28 b	1.54 b
Furadan 4F	16.0	47.96	4.90 c	2.86 b	5.04 b	2.72 b
LSD; *P* = 0.05		NS	12.89	8.97	3.79	2.39

Means within columns followed by the same letter are not significantly different.
[w] Pre-treatment.
[x] Days after treatment.

Table 3. Pea Aphids per Stem, Holtville, CA, 2008.

Treatment	oz/acre	PT[w]	3 DAT[x]	7 DAT	14 DAT[v]	21 DAT
Untreated	--------	1.12	0.34	0.86 a	0.46 a	0.38
Lorsban 4E	32.0	0.80	0.10	0.48 abc	0.32 ab	0.76
Lorsban Advanced	32.0	0.96	0.02	0.28 bc	0.09 c	0.42
Radiant + Dimethoate 267E	8.0 + 16.0	0.58	0.02	0.08 c	0.15 bc	0.14
Entrust 80 + M-Pede	1.25 + 1% v/v	0.96	0.12	0.58 ab	0.17 bc	0.14
Furadan 4F	16.0	0.96	0.08	0.18 bc	0.16 bc	0.16
LSD; *P* = 0.05		NS	NS	*P* = 0.1; LSD = 0.46	0.20	NS

Means within columns followed by the same letter are not significantly different.
[v] Log transformed data used for analysis.
[w] Pre-treatment.
[x] Days after treatment.

Table 4. Aphid Parasitic Wasps per Ten Sweeps in Alfalfa, Holtville, CA, 2008.

Treatment	oz/acre	PT[w]	3 DAT[x]	7 DAT	14 DAT	21 DAT
Untreated	--------	0.00	0.00	6.00	56.80 a	5.60 a
Lorsban 4E	32.0	0.00	0.00	4.80	19.20 b	1.80 b
Lorsban Advanced	32.0	0.00	0.00	2.80	25.80 ab	2.00 b
Radiant + Dimethoate 267E	8.0 + 16.0	0.00	0.00	4.00	10.80 b	3.00 ab
Entrust 80 + M-Pede	1.25 + 1% v/v	0.00	0.00	3.80	11.20 b	2.80 ab
Furadan 4F	16.0	0.00	0.00	2.80	13.00 b	1.60 b
LSD; *P* = 0.05		NS	NS	NS	31.90	2.89

Means within columns followed by the same letter are not significantly different.
[w] Pre-treatment.
[x] Days after treatment.

Table 5. Minute Pirate Bugs per Ten Sweeps in Alfalfa, Holtville, CA, 2008.

Treatment	oz/acre	PT[w]	3 DAT[x]	7 DAT	14 DAT	21 DAT
Untreated	--------	0.00	0.20	2.80	3.80 a	0.80
Lorsban 4E	32.0	0.40	0.40	2.60	1.00 b	0.60
Lorsban Advanced	32.0	0.60	1.00	1.20	2.00 b	0.20
Radiant + Dimethoate 267E	8.0 + 16.0	0.40	0.20	0.80	0.80 b	0.60
Entrust 80 + M-Pede	1.25 + 1% v/v	0.00	0.40	1.40	1.00 b	0.60
Furadan 4F	16.0	0.00	0.20	0.00	0.60 b	1.00
LSD; *P* = 0.05		NS	NS	NS	1.57	NS

Means within columns followed by the same letter are not significantly different.
[w] Pre-treatment.
[x] Days after treatment.

Table 6. Damsel Bugs per Ten Sweeps in Alfalfa, Holtville, CA, 2008.

Treatment	oz/acre	PT[w]	3 DAT[x]	7 DAT	14 DAT	21 DAT
Untreated	--------	0.00	2.20	0.20	2.60	2.60 a
Lorsban 4E	32.0	0.00	0.60	0.40	1.40	0.40 b
Lorsban Advanced	32.0	0.00	1.40	0.20	1.20	0.20 b
Radiant + Dimethoate 267E	8.0 + 16.0	0.00	0.80	0.60	1.00	0.40 b
Entrust 80 + M-Pede	1.25 + 1% v/v	0.00	1.00	0.40	2.20	1.20 ab
Furadan 4F	16.0	0.00	1.20	0.40	1.00	0.80 b
LSD; *P* = 0.05		NS	NS	NS	NS	1.50

Means within columns followed by the same letter are not significantly different.
[w] Pre-treatment.
[x] Days after treatment.

Table 7. Lady Beetles per Ten Sweeps In Alfalfa, Holtville, CA, 2008.

Treatment	oz/acre	PT[w]	3 DAT[x]	7 DAT	14 DAT[v]	21 DAT[v]
Untreated	--------	0.00	2.60 a	7.60 ab	1.64 a	1.27 a
Lorsban 4E	32.0	0.00	0.80 b	6.40 abc	0.82 bc	0.57 b
Lorsban Advanced	32.0	0.20	0.40 b	0.80 bc	0.75 bc	0.18 b
Radiant + Dimethoate 267E	8.0 + 16.0	0.20	0.00 b	2.40 bc	0.96 b	0.53 b
Entrust 80 + M-Pede	1.25 + 1% v/v	0.40	1.00 b	9.80 a	1.69 a	1.20 a
Furadan 4F	16.0	0.20	0.20 b	0.00 c	0.52 c	0.22 b
LSD; *P* = 0.05		NS	1.35	7.25	0.42	0.46

Means within columns followed by the same letter are not significantly different.
[v] Mean separations within columns by $LSD_{0.05}$.
[w] Pre-treatment.
[x] Days after treatment.

Table 8. Spiders per Ten Sweeps in Alfalfa, Holtville, CA, 2008.

Treatment	oz/acre	PT[w]	3 DAT[x]	7 DAT	14 DAT	21 DAT
Untreated	--------	0.00	3.20 a	1.00 a	1.20	1.40
Lorsban 4E	32.0	0.00	0.60 b	0.00 b	0.40	1.80
Lorsban Advanced	32.0	0.00	1.20 b	0.20 b	1.00	0.60
Radiant + Dimethoate 267E	8.0 + 16.0	0.00	1.20 b	0.00 b	0.80	1.20
Entrust 80 + M-Pede	1.25 + 1% v/v	0.00	1.20 b	0.00 b	0.60	0.40
Furadan 4F	16.0	0.20	1.00 b	0.00 b	0.60	1.00
LSD; *P* = 0.05		NS	1.56	0.61	NS	NS

Means within columns followed by the same letter are not significantly different.
[w] Pre-treatment.
[x] Days after treatment.

CIMIS REPORT

Khaled Bali and Steve Burch*

California Irrigation Management Information System (CIMIS) is a statewide network operated by California Department of Water Resources. Estimates of the daily reference evapotranspiration (ET_o) for the period of December 1 to February 28 for three locations in the Imperial County are presented in Table 1. ET of a particular crop can be estimated by multiplying ET_o by crop coefficients. For more information about ET and crop coefficients, contact the UC Imperial County Cooperative Extension Office (352-9474) or the IID, Irrigation Management Unit (339-9082). Please feel free to call us if you need additional weather information, or check the latest weather data on the worldwide web (visit http://tmdl.ucdavis.edu and click on the CIMIS link).

Table 1. Estimates of daily Evapotranspiration (ET_o) in inches per day

Station	December		January		February	
	1-15	16-31	1-15	15-31	1-15	16-28
Calipatria	0.07	0.07	0.08	0.09	0.12	0.14
El Centro (Seeley)	0.06	0.06	0.08	0.09	0.12	0.14
Holtville (Meloland)	0.06	0.06	0.08	0.09	0.12	0.14

* Irrigation Management Unit, Imperial Irrigation District.