Considerations in Assessing Potential Hazards & Risks from Animal Activity in the Field

Overview

- Animals are one of several potential sources of foodborne pathogens that could contaminate fresh produce.

- Most foodborne pathogens that come from animals live naturally in the gut of healthy domestic and wild animals.

- The pathogen is excreted in the feces and may also be found in the animal's oral cavity (mouth, tonsils), fur, feathers, hooves, or skin.

FDA FSMA – Produce Safety Rule

- Agricultural water
- Biological soil amendments of animal origin
- Worker health and hygiene
- Equipment, tools, buildings and sanitation
- Domesticated and wild animals
- Growing, harvesting, packing and holding activities
- Sprouts requirements

FDA FSMA – Produce Safety Rule

- (Proposed §§ 112.83 and 112.112) If under the circumstances there is a **reasonable** probability that animal intrusion will contaminate covered produce, you would be required to monitor for evidence of animal intrusion immediately prior to harvest and, as needed, during the growing season.

- If you see evidence of animal intrusion, such as **significant** quantities of animals, animal excreta, or crop destruction via grazing, you must evaluate whether the covered produce can be safely harvested. For example, if you see evidence of bird excreta on a head of lettuce, you would not be allowed to harvest it.

Source:
http://www.fda.gov/Food/guidanceregulation/FSMA/ucm334114.htm

LGMA

CALIFORNIA LEAFY GREEN PRODUCTS
HANDLER MARKETING AGREEMENT

LATEST NEWS

LGMA Applauds New Government Food Safety Initiative
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CDFA Secretary A.G. Kawamura and Joe

SIX PRINCIPLE ELEMENTS.
ONE MODEL FOOD SAFETY PROGRAM.

INFORMATION

Buyers/Trade >
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Assessing Risk from Animal Activity

- Fecal matter or animal hazard observed
  - Indications of animal hazard may include feeding, skin, feathers, or other signs of animals – present in the area to be harvested – in sufficient number and quantity - so as to suggest to a reasonable person the crop may be contaminated

Considerations in Assessing Potential Hazards and Risks Associated with Animal Activity in the Field (domestic, wild)

- Volume and concentration of fecal material in the field and production area

- Frequency of animal sightings and sign (e.g., tracks, scat, rubbing, animal damage to crop)

- Animal species likely to aggregate (e.g., flocks and herds) and produce concentrated areas of fecal material and incidental contact with the crop

Considerations in Assessing Potential Hazards and Risks Associated with Animal Activity in the Field (domestic, wild)

- Potential for animal to transport pathogens from a high risk source (e.g., CAFO, garbage dump, sewage treatment facility) to the field

- Species with seasonal migrations that result in increased population density and potential for activity in the field

Animal Hazard/Activity Species, Location, and Crop Specific

Seasonal Considerations

Domestic Livestock (confined, pastured)

Potential increased risk:

- Loose animals in field
- Bioaerosols, dust
- Fecal runoff (in wet season)
- Pathogen "spillover" to free-roaming wildlife

Large Fauna: Feral Pigs, Javelina

<u>Potential increased risk</u>:

- Foraging, rooting in the field
- High population numbers
- Repeated intrusion/defecation

HIGH RISK SCENARIO - 1

2006 *E. coli* O157 Spinach Outbreak, Multi-State 205 infections, 3 deaths

High density of feral pigs sharing pasture with cow-calf beef operation on land adjacent to spinach field

Outbreak strain isolated from cattle and feral pig feces

Jay et al., 2007

Large Fauna: Deer and Elk

<u>Potential increased risk</u>:

- Grazing/foraging in the field
- High population numbers/large herds
- Repeated intrusion/defecation

HIGH RISK SCENARIO - 2

2011 *E. coli* O157 Strawberry Outbreak, Oregon

15 infections, 2 deaths

High density of black-tailed deer and fecal droppings in strawberry fields

Outbreak strain isolated from deer feces

Laidler, et al. 2013

Wild Birds: Passerines, Corvids, Waterfowl

Potential increased risk:

- Social bird species that aggregate in large numbers
- Migratory species feeding in fields during growing/harvest season
- Frequent transit between high risk location (e.g., CAFO, lagoon, landfill)

HIGH RISK SCENARIO - 3

2008 *Campylobacter jejuni* Pea Outbreak, Alaska

63 infections, 1 GBS (paralysis)

~20,000 migrating Sandhill cranes in Pacific Flyway/wildlife refuge located~10 miles from the pea farm; cranes observed in pea fields daily through harvest

Outbreak strain isolated from Sandhill crane feces, pea-soil mixture

Gardner el al., 2011

Small Carnivores: Coyote, Dog, Raccoon

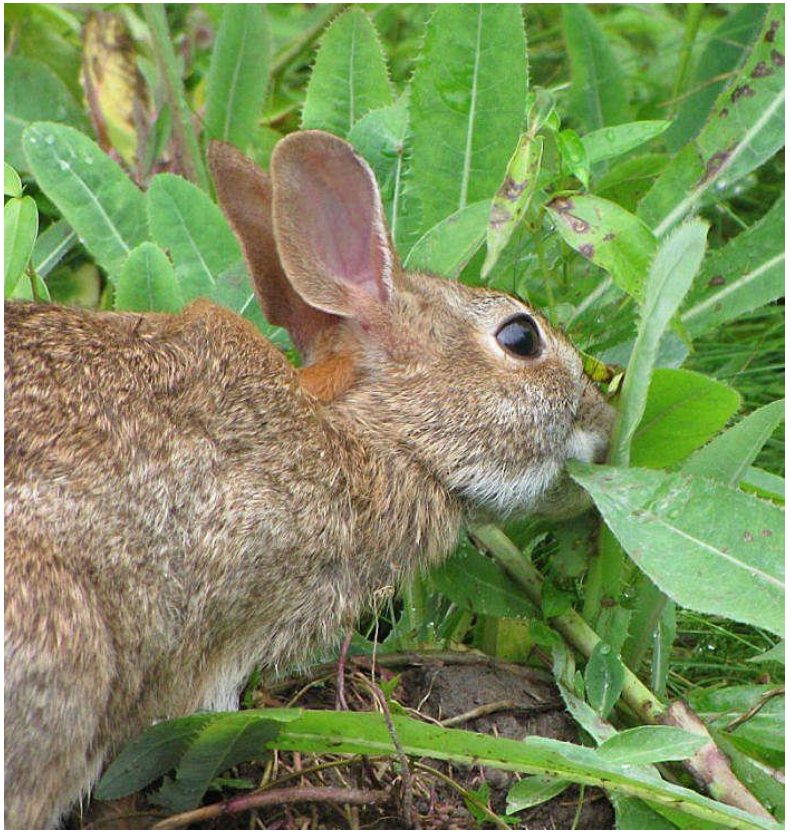
<u>Potential increased risk</u>:

- Transiting through fields, roads between fields, defecation (contaminate equipment)
- Stray dogs in groups/packs
- Raccoon "latrine" in production or storage areas

Rodents and Rabbits

<u>Potential increased risk</u>:

- Foraging in field (damage may be found on edges)
- Temporal population explosions (may be measured by increased crop damage, trap success)



Amphibians and Reptiles

<u>Potential increased risk</u>:
- Migration into fields for feeding or breeding
- Possible source of *Salmonella* in surface water (tailwater ponds) – risk likely higher in eastern US where untreated farm ponds used for irrigation

Environmental Factors

- Climate/Season
  - Prevalence of *E. coli* O157 known to increase in summer-fall on feedlots
  - Increased opportunity for runoff from animal operations during wet season and bioaerosol transmission during dry/dusty season
  - Fluctuations in population density of migratory bird populations

Production Factors

- Fecal material in field close to harvest
- Risk of "splash" and survival following overhead irrigation event (field trials in Salinas Valley and Yuma)

Summary

Higher risk scenarios:

•Repeated foraging and defecation in the leafy green crop field production area by groups of 3 or more large mammals (deer, feral pigs) or large flocks of social birds (e.g., blackbirds, starlings, crows, geese, etc.) with visible fecal matter and/or other animal hazard (e.g., feeding, skin, fur, feathers).

Risk further increased if:

•Presence of a CAFO, lagoon, landfill, etc. near the field (depending on animal species home range)

•Time of contamination is close to harvest and final overhead irrigation event

•Season/climate favorable to pathogen dissemination

Summary

Medium risk scenarios:

- Fresh fecal material on road dividing crop fields

- Increased number of rodents found in traps around a leafy green production area, but no apparent sign of an animal hazard such as feeding (note that rodent fecal matter may not be seen by routine visual inspection)

- Identification of a raccoon latrine, rodent nests, or other signs of infestation in equipment storage area

Summary

Lower (negligible) risk scenarios:

•Sign of animal tracks into the leafy green production area by a single small rodent/rabbit, carnivore (raccoon, skunk, stray dog) or opossum with minimal to no fecal deposition or other indicators (feeding, fur).

•Solitary bird fecal deposit on a plant or soil near the plant

•Observation of wildlife in surrounding habitat without evidence of fecal matter or sign of other animal hazards in the leafy green production area. For example, tadpoles in a pond (water not applied to leafy green fields and no sign of animal activity in the field)

The Conservation Controversy

- Three broad areas of concern identified in the central California coast where food safety and conservation goals may have conflicts.

1. Wildlife management
2. Non-crop vegetation management
3. Water body management

Wildlife Management

Lethal:

- Legal Sport Hunting
- Depredation Permit
- Baiting

Non-Lethal:

- Fencing
- Buffers
- Scare tactics (noise makers)

Co-Management

"an approach to minimize microbiological hazards associated with food production while simultaneously conserving soil, water, air, wildlife, and other natural resources."

Evaluation of falconry as an economically viable co-management strategy to deter nuisance birds in leafy green fields

Falconry to Deter Nuisance Birds in Produce Fields

Assessing risk in animal-based soil amendments

Michele Jay-Russell, DVM, PhD
Western Center for Food Safety, UC Davis

Objectives

- Overview of key risk factors manure, compost, supplements
- A research-based assessment of manure pre-plant intervals
- Real World Case Study

Definitions

Soil amendment: any chemical, biological, or physical materials intentionally added to the soil to improve and support plant growth and development (e.g., raw animal manure, composted animal manure, chemical, green waste, biosolids)

Compost: product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

Biological Soil Amendments: Benefits of Using Compost

- Improves the soil structure, porosity, and density
- Increases infiltration and permeability of heavy soils
- Improves water holding capacity
- Supplies a variety of macro and micronutrients.
- May control or suppress certain soil-borne plant pathogens
- Supplies significant quantities of organic matter.
- Improves cation exchange capacity (CEC) of soils and growing media
- Supplies beneficial microorganisms to soils and growing media
- Improves and stabilizes soil pH

Source: US Composting Council

Biological Soil Amendments (BSA): Raw Animal Manure

- Some of the same benefits as compost and less expensive, but significantly increased risk of carrying human pathogens that may contaminate the crop

- BSAs of animal origin: ruminants (cattle, sheep, goats, buffalo, farmed deer), horse, poultry, camelids (llamas, alpacas), rabbits, swine, zoological animals

"Untreated" biological soil amendments of animal origin

- Raw manure
- Aged or stacked manure
- Untreated manure slurries (dairy, swine lagoons)
- Compost teas made with raw manure
- Any soil amendment mixed with raw manure

Pathogen survival in feces, soil, and crops

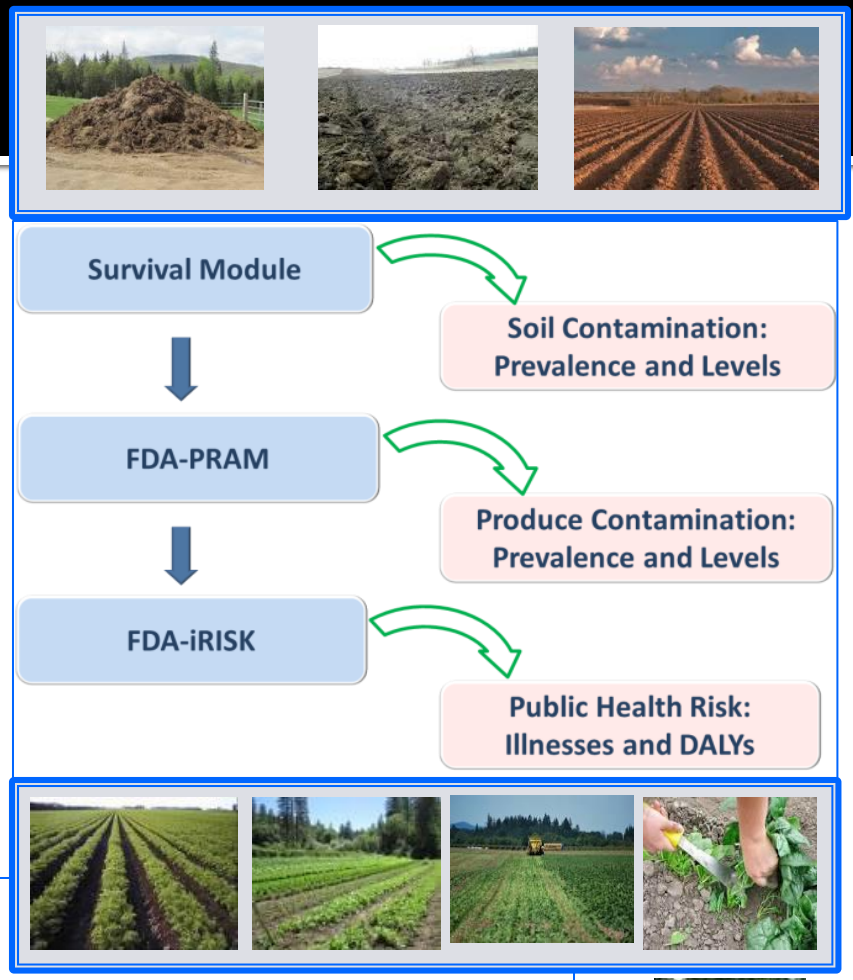
Type of pathogen	Survival time in days			
	In faeces, nightsoil and sludge	In fresh-water and sewage	In the soil	On crops
Viruses				
Enteroviruses	<100 (<20)*	<120 (<50)	<100 (<20)	<60 (<15)
Bacteria				
Faecal coliforms	<90 (<50)	<60 (<30)	<70 (<20)	<30 (<15)
Salmonella spp.	<60 (<30)	<60 (<30)	<70 (<20)	<30 (<15)
Shigella spp.	<30 (<10)	<30 (<10)	-	<10 (<5)
Vibrio cholera	<30 (<5)	<30 (<10)	<20 (<10)	<5 (<2)
Protozoa				
Entamoeba histolytica cysts	<30 (<15)	<30 (<15)	<20 (<10)	<10 (<2)
Helminths				
Ascaris lunbricoides eggs	Many months	Many months	Many months	<60 (<30)

Source: Feachem *et al.*, 1983

* Figures in brackets show the usual survival time

BACKGROUND

- FDA is conducting a risk assessment and, in collaboration with the USDA and other stakeholders, is undertaking critical research to strengthen scientific support for any future proposal regarding the appropriate time interval(s) between application of biological soil amendments and harvest.



Relevance to FDA's Mission:

This research fills critical knowledge gaps on pathogen survival times and intervals between the application of untreated biological soil amendments of animal origin and crop harvesting. Data will be used to conduct a risk assessment relevant to FSMA Produce Safety Rule proposals to ensure public health.

FDA FSMA – Produce Safety Rule

Focus on conditions and practices identified as potential contributing factors for microbial contamination

- Agricultural water
- Biological soil amendments of animal origin
- Worker health and hygiene
- Equipment, tools, buildings and sanitation
- Domesticated and wild animals
- Growing, harvesting, packing and holding activities
- Sprouts requirements

FDA FSMA – Produce Safety Rule

Risk Assessment

Regulatory context

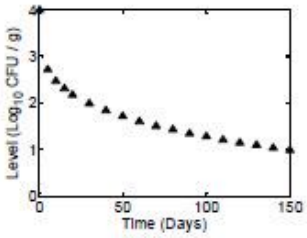
- FDA Food Safety Modernization Act (FSMA), Produce Safety Rule published
- FDA has reserved its decision on the minimum time interval or intervals between the application of untreated Biological Soil Amendments of Animal Origin (BSAAO) and crop harvesting

FDA FSMA – Produce Safety Rule

Risk Assessment

Key points to consider in assessing exposure

1	2	3	4
Pathogens may be present in BSAAO	Pathogens present may persist in amended soil	Pathogens may be transferred from amended soil to produce	Pathogens present may be impacted by handling practices, storage conditions



FDA FSMA – Produce Safety Rule

- No time for **composted biological soil amendments of animal origin** (including composted manures) that meet these standards:
  - It is processed to meet a microbial standard specified in the Produce Safety rule
  - It is applied in a manner that minimizes the potential for contact with produce during and after application.

- The FDA, along with multiple other federal, state and private entities, believes that properly composted manure is safer than raw manure from a public health standpoint and is more environmentally sustainable.

USDA National Organic Program: Raw Manure Standard

- Regulation (§205.203(c)(1)) specifies that "raw" fresh, aerated, anaerobic, or "sheet composted" manures may only be applied on perennials or crops not for human consumption
- Uncomposted manures must be incorporated at least four months (120 days) before harvest of a crop for human consumption, if the crop contacts the soil or soil particles.
- If the crop for human consumption does not contact the soil or soil particles (e.g. sweet corn), raw manure can be incorporated up to 90 days prior to harvest. Biosolids, sewage sludge, and other human wastes are prohibited. Septic wastes are prohibited, as well as anything containing human waste.

FDA FSMA – Produce Safety Rule

- Proposed rule does not intend to take exception with farmers complying with the standards established under USDA's National Organic Program, which calls for a 120-day interval between the application of manure and harvest for crops in contact with the soil and 90 days for crops not in contact with the soil.

Leafy Green Marketing Agreement: Raw Manure

The Best Practices Are

- DO NOT USE raw manure or soil amendment that contain un-composted, incompletely composted animal manure and/or green waste or non-thermally treated animal manure to fields which will be used for lettuce and leafy green production.

- For previously treated fields, a 1 year waiting period shall be observed before planting any variety of leafy green crops.

Federal Register Notice – (3/4/16, Closes – 7/5/15)

Risk Assessment of Foodborne Illness Associated with Pathogens from Produce Grown in Fields Amended with Untreated Biological Soil Amendments of Animal Origin; Request for Comments, Scientific Data, and Information

FDA, in consultation with USDA, is conducting the risk assessment to evaluate and, if feasible, quantify the risk of human illness associated with the consumption of produce grown in fields or other growing areas amended with untreated BSAAO

- Assess Impact of certain interventions, such as use of a time interval or intervals between application and harvest, on the predicted risk

Impact of Application Intervals for the Use of Raw Animal Manure as a Soil Amendment

Saharuetai Jeamsripong[1], Patricia D. Millner[2], Manan Sharma[2], David Oryang[3] and Michele Jay-Russell[1]

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[2] U.S. Department of Agriculture, Agricultural Research Service, Beltsville, MD
[3] Food and Drug Administration, Center for Food Safety and Applied Nutrition, College Park , MD

Objectives

1. To examine the survival of indicator *E. coli* cocktail strains applied to soil amended with manure and potential transfer to tomatoes grown in inoculated soil.

2. To compare survival of indicator *E.coli* in soil amended with different animal manure types.

Methods

- Field plots (1m x 2m) were amended by surface application of cattle, chicken litter, horse, goat manure, and no manure with 4 replications each (n = 40 plots) plus 4 controls (no inoculum).

- Three strains of indicator *E.* coli-Rif^{r} (TVS 353, 354, 355), originally isolated from Salinas Valley, CA (Trevor Suslow) used as a "cocktail were inoculated in high (10^{7} CFU/ml) or low (10^{4} CFU/ml) concentration as a 1L fecal slurry using a backpack sprayer.

Trial 2: tomato and soil samples

- Tomatoes harvested from month 4 (120 days) to month 7 after application of raw manure
- 4-5 tomato fruits harvested per plot plus soil composites

Results – Trial 1

Figure 3: Survival of indicator *E. coli* inoculated in high (10^6-10^7 CFU/ml) bacterial concentrations in different manures spread on field plots

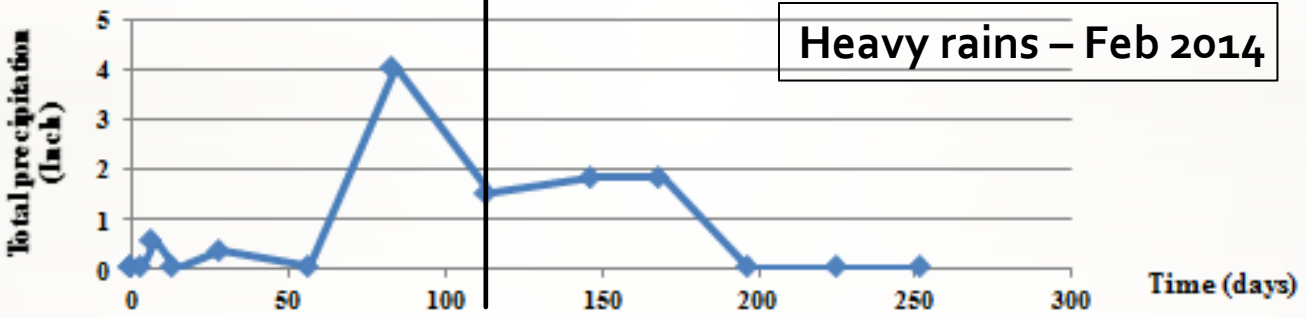

Figure 4: The total precipitation was measured in the Davis weather station #6, Sacramento Valley provided from the California Irrigation Management

Information System (CIMIS)

Real World Case Study

ORIGINAL ARTICLE

Salmonella Oranienburg Isolated from Horses, Wild Turkeys and An Edible Home Garden Fertilized with Raw Horse Manure

M. T. Jay-Russell*, J. E. Madigan, Y. Bengson, S. Madigan, A. F. Hake, J. E. Foley and B. A. Byrne

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Impacts

- Routine faecal screening for *Salmonella* as part of the veterinary teaching hospital's infection control protocol facilitated identification of equine salmonellosis infections on a ranch in coastal Northern California.
- The *S.* Oranienburg clinical strain was found in multiple farm samples including faeces from symptomatic and asymptomatic stable mates, a healthy pet dog, wild turkeys, stored manure, water troughs and soil from the family's edible home garden.
- Viable *S.* Oranienburg persisted an estimated 210 days in garden soil fertilized with raw horse manure.

Background

- In July 2010, an adult draft horse mare ("Index Case") from the Northern California coast with a history of recurrent fevers was admitted to the Veterinary Medical Teaching Hospital for colic surgery.
- Routine admission fecal sample was culture-positive for *Salmonella enterica* serotype Oranienburg.

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FARM

Forested pasture

Forested pasture

Barn and Manure Pile
~200 m from garden

Manure Pile
~1,000 m from garden

House

Edible Home Garden
~12 m x 8 m

Background

- The owners reported that other horses on ranch had signs of fever.
- No other known salmonellosis cases in the area.
- Raw horse manure used as fertilizer in the family's edible home garden.

Background

- A larger than usual population of wild turkeys had been seen on their farm during summer 2010.
- Groups of over 30 turkeys often congregated in the horse pens, feeding areas, and around water troughs.

Photo by National Wild Turkey Federation

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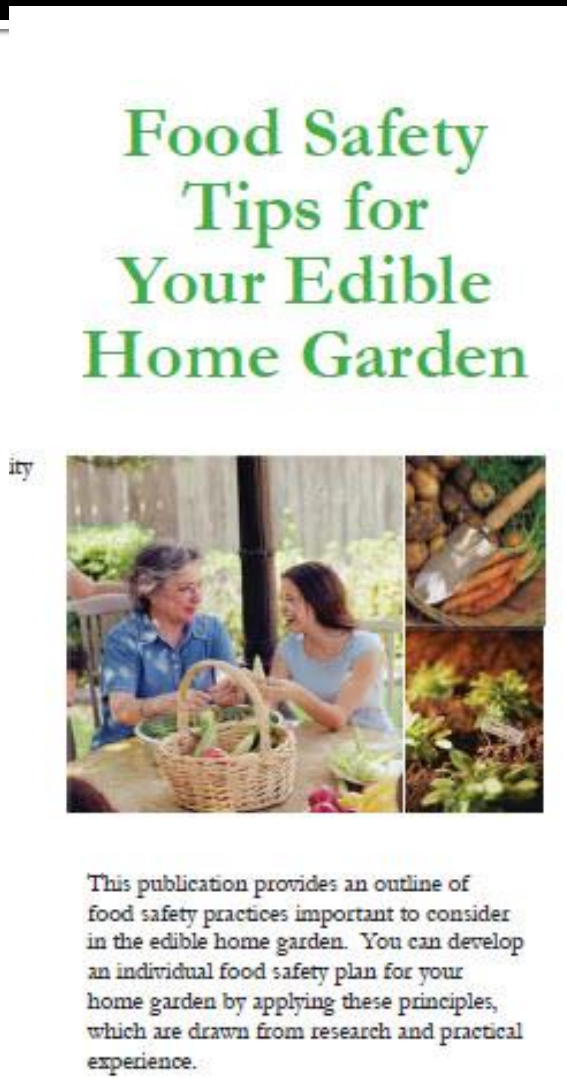
Results

Sample type	No. positive/ No. tested	Percent positive
Horse	6/8	75%
Dog	1/1	100%
Cat	0/1	0
Water trough	2/7	29%
Manure pile	4/8	50%
Rabbit pellets	0/1	0
Turkey feces	16/71	22%
Garden soil	9/51	18%
Garden vegetables	0/10	0
Well water	0/7	0

Conclusions


Food Safety Tips for Your Edible Home Garden

ity

This publication provides an outline of food safety practices important to consider in the edible home garden. You can develop an individual food safety plan for your home garden by applying these principles, which are drawn from research and practical experience.

- The outbreak illustrates the potential for widespread dissemination of a rare *Salmonella* serotype in a ranch environment.
- The results also underscore the need to educate the public about food safety hazards associated with using raw manure on edible home gardens.

CATTLE AND POULTRY MANURE NEEDED FOR RESEARCH STUDY

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