Backyard and Pasture Poultry Workshop

Healthy Animals, Healthy People Workshop

Pasture-based and Integrated Systems: Food Safety Perspective

San Jose, March 2, 2019

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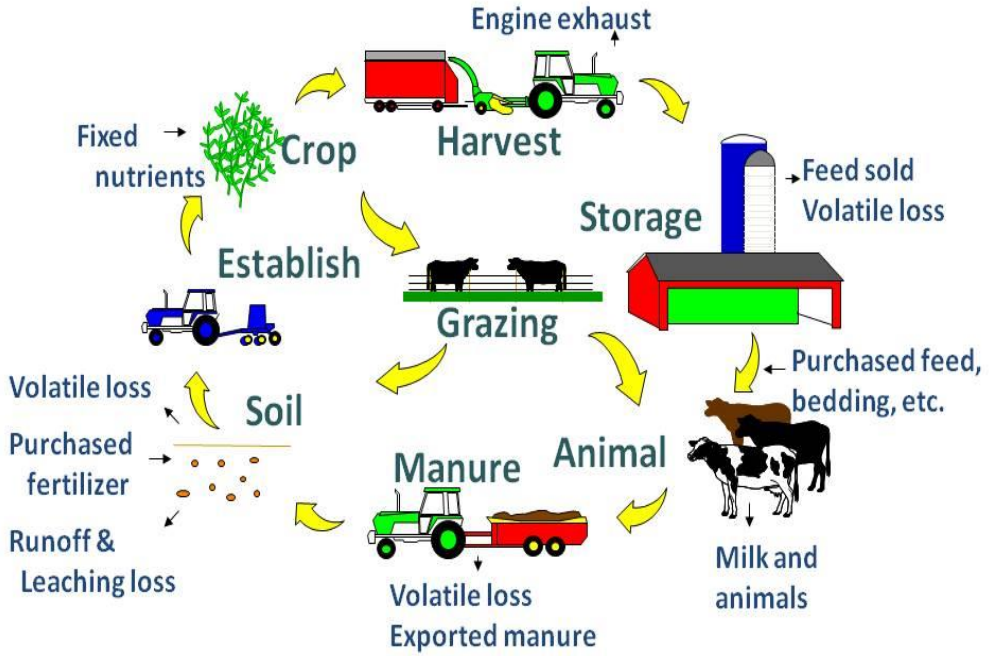
UCDAVIS VETERINARY MEDICINE

University of California Agriculture and Natural Resources

Livestock on Diversified Farms:
Integrated Crop-Livestock Systems

- Mixed/integrated crop-livestock systems are farms where animals and crops are raised with the goal of utilizing the products of one for the growth of the other *(Hilimire, 2011)*



Adapted from www. ars.usda.gov

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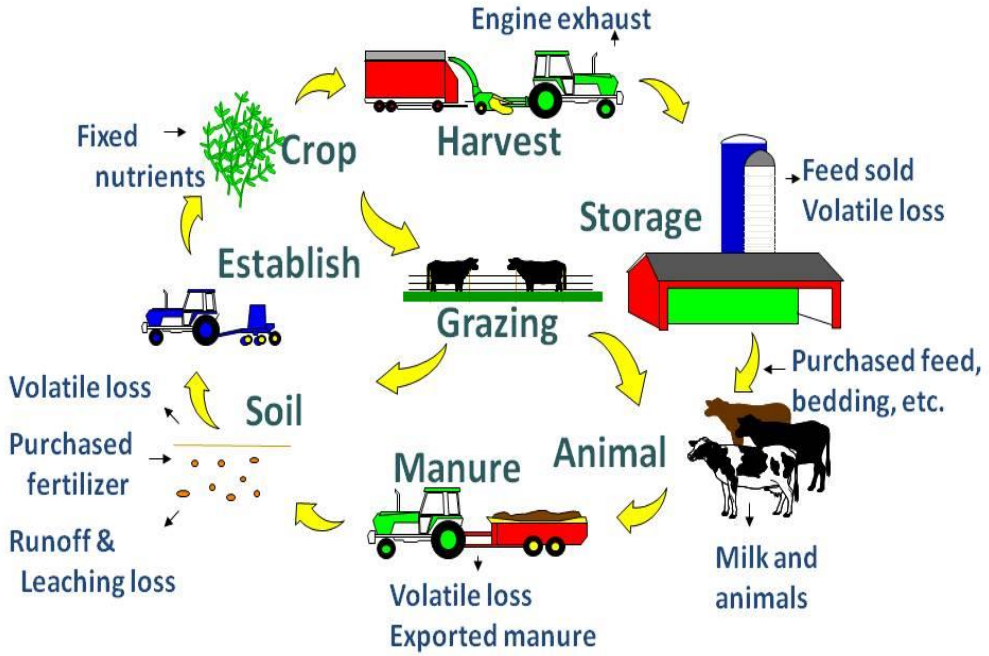

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- **Other terms:**
  - Mixed crop-livestock systems
  - Integrated farms
  - Bio-diversified farms
  - Diversified farms

Livestock on Diversified Farms:
Integrated Crop-Livestock Systems

Specialized systems

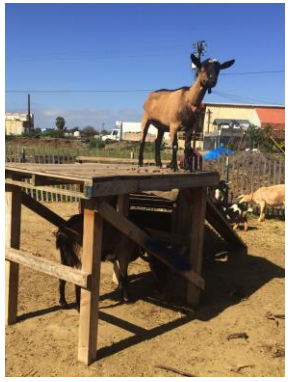

Courtesy of Monique Gunther


Adapted from Wikipedia

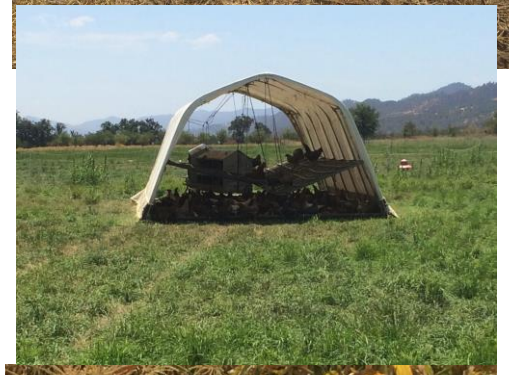
Integrated systems

Livestock on Diversified Farms:
Integrated Crop-Livestock Systems

Spatially Separated



Rotational

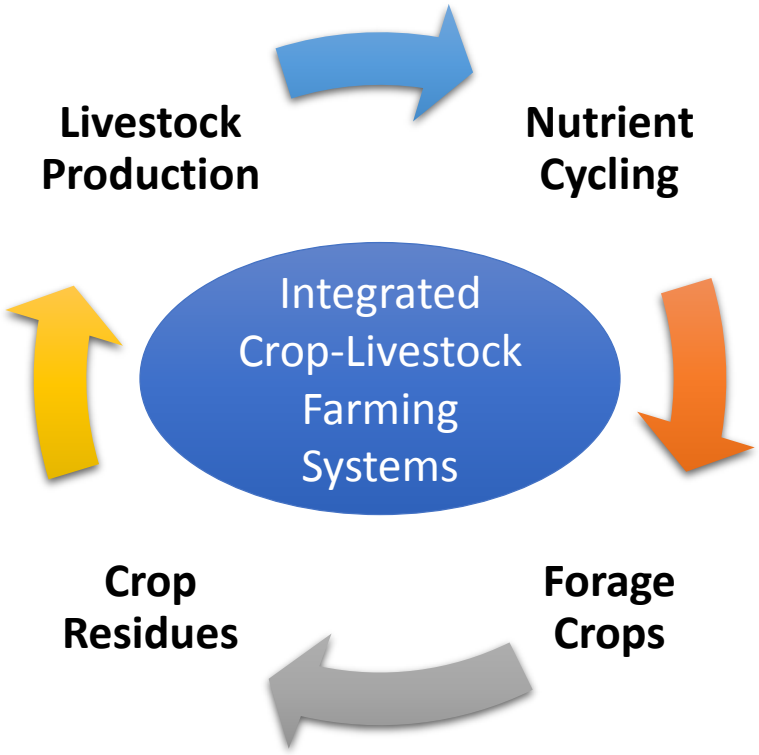


Fully Combined

Livestock on Diversified Farms:
Integrated Crop-Livestock Systems

Benefits

- **Fertilize the soil** with on-farm input, livestock manure
- Encourage and allow growers to maintain **semi-permanent pasture fields**, which can **improve soil quality**
- Increase **crop yield**
- Enhance **on-farm bio-diversity** and related **ecosystem services**: pollination, weed/pest management
- Enhance **economic gain** to growers
- Confer **social benefits** to **growers and communities**
- **Sustainability** *(Hilimire, 2011)*



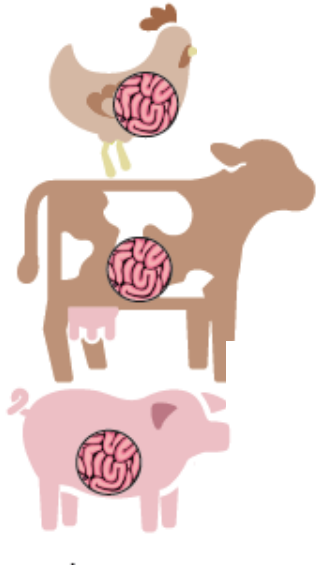
Foodborne Pathogens
Animals on Diversified Farms

- Certain **animals** are **reservoirs** for certain pathogens
- What can **affect animals shedding** in their feces
  - Age (e.g. young animals)
  - Husbandry practices (e.g. stocking density)
  - Diet (e.g. distillers grain)
  - Season (summer)
  - Environmental conditions
- **Good Husbandry Practices** (prevention)

Salmonella
Campylobacter

E. coli O157:H57
Salmonella
Campylobacter

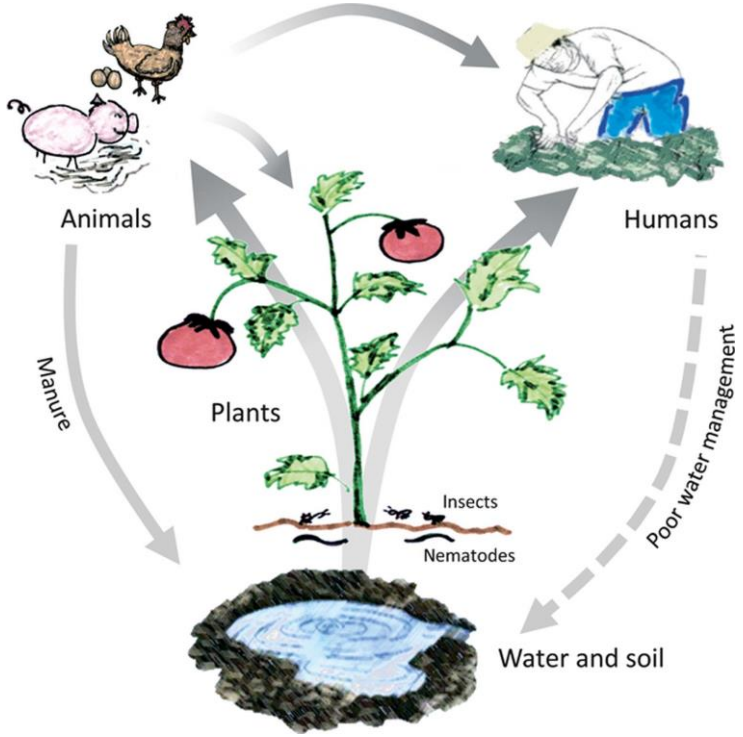
Salmonella
Campylobacter



Adapted from CDC,NARMS

Foodborne Pathogens
Animals on Diversified Farms

- All manures can carry pathogens (causing human illness)
- There is an increased **risk of pathogen spread** via food products (e.g., vegetables, fruits and nuts) when **manure is applied to crop fields**
- The direct and indirect use of manure in crops increases the potential for exposure to foodborne pathogens and consequently can become a food safety hazard



Casandra Hernández-Reyes, and Adam Schikora FEMS Microbiol Lett 2013;343:1-7

Foodborne Pathogens
Manure & Risk Reduction

Soil

- Enteric Pathogens can persist for long periods in the soil:
  - ***Salmonella*** can persist in the litter applied to fields for almost **4 months,** can survive up to **2 years**
  - ***Campylobacter*** can persist for about **25 days**

- Factors affecting the survival in the soil: livestock species, pathogen, manure type, composition (e.g., humidity, dry matter), soil type, environmental conditions (e.g. season, ambient temperature, rainfall, sunlight, etc.)

Foodborne Pathogens
Manure & Risk Reduction

- Application of raw manure (untreated manure, litter, bedding, aged manure)

- Application of treated/ composted manure

- Integration of animals: Pasture-based and grazing systems

Manure & Risk Reduction

Good Agricultural Practices (GAPs)

- Selection
- **Handling and storage**
- **Application timing (time-interval)**
- **Application methods**
- Treatment : **composting**, heat treatment
- Record keeping

Foodborne Pathogens
Manure & Risk Reduction

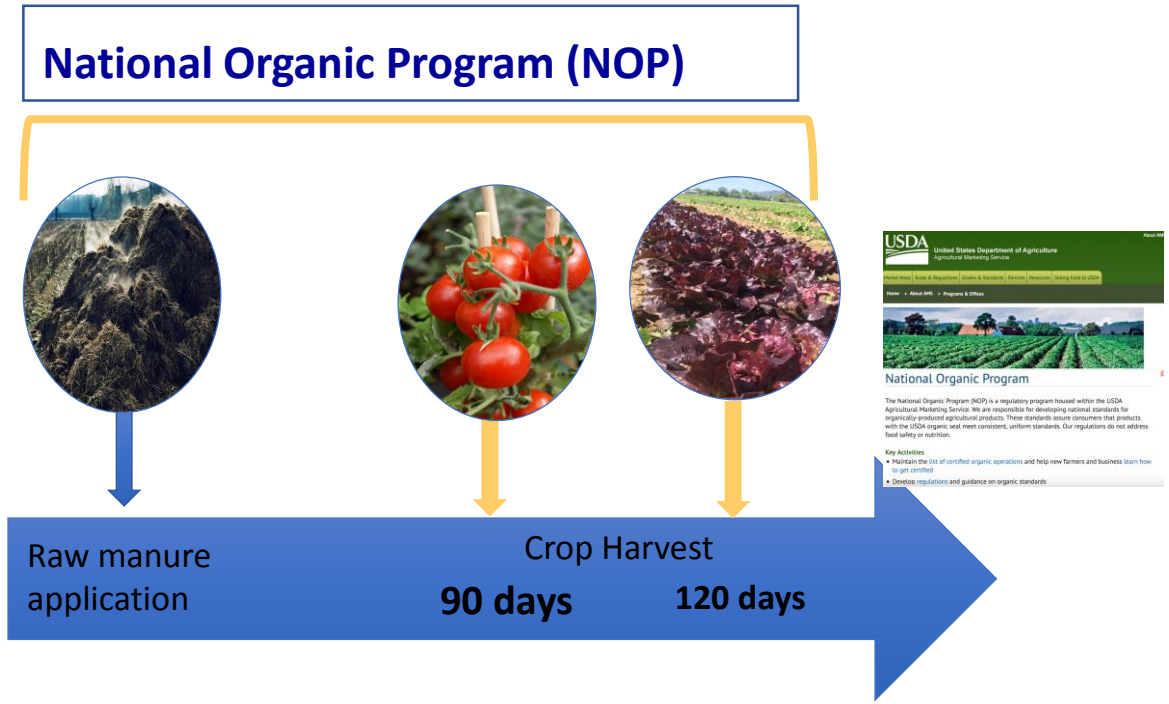
Handling & Storage

- Storage area physically isolated from vegetable garden, open water sources
- Avoid re-contamination (wildlife, pests, etc.)
- Barriers to minimize the risk of leaching, runoff or spreading by wind (roof, surface water diversions to prevent runoff from and into storage area)
- Treatment (e.g., composting, heat treatment)

Foodborne Pathogens
Manure & Risk Reduction

Manure Application

- The prevention of microbial contamination of crops has been **based on time-interval criteria** between the **application of raw manure and crop harvesting**
- Planning the timing for manure application & harvesting
- Apply to crops eaten cooked (e.g., potatoes)



Foodborne Pathogens
Manure & Risk Reduction

Manure Application

- Manure application and buffer zones
- Application methods and incorporation into the soil as soon as possible
- Minimize the contact of produce with manure (e.g., plastic mulch)
- Manure should not used to side-dress or top-dress crops
- Cover residues or cover crops to minimize manure nutrient leaching or runoff from fields (filter strips)
- Detail records of treatment methods, application (rates, methods, dates, etc.)

Foodborne Pathogens
Compost criteria for animal manure

Principles:

- The proper materials
  - Manure sources (different livestock species, bedding material, green waste, etc.)
  - Carbon sources (types)
- Surface area/ particle size
- Volume (challenging for small farms and backyard producers)
- Moisture (moisture level of 40-60)
- Aeration (microbes need oxygen to efficiently decompose complex organic material)
- Temperature (increases as the biological activity of the pile increases)
- Carbon to Nitrogen ratio (ideal 30:1)

- **Survival of pathogens**
- **Risk for re-contamination**

Foodborne Pathogens
Proprieties of Composting Process to Control Foodborne Pathogens

- **Heat (temperature)** is the primary factor responsible for inactivation of foodborne pathogens during aerobic composting of animal manures
  - Developing and holding temperatures **above 55ºC: (131 ºF) for 3 days for static piles or in-vessel systems** and **15 days for turned windrows**, followed by **curing stage (45 days, 2 to 4 months)**

Figure 1. Backyard composting systems. From left to right: three bin composter, tumbler composter, enclosed static bin. At far right is the start of a pile.

Foodborne Pathogens

Proprieties of Composting Process to Control Foodborne Pathogens

- One of the major characteristics of composting systems that affects pathogen inactivation is **temperature** &**moisture** (stratification)
- Amounts of heat generated depends on **feedstocks incorporated** (e.g., straw, woody materials, rice hulls, shredded paper). C:N Ratio (bedding 25% manure:67% bedding; and feedstocks)

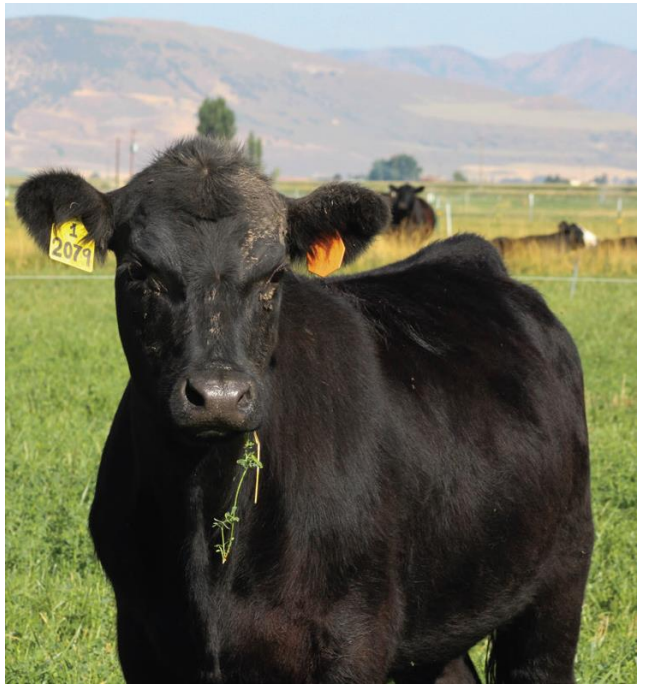
Wood and wire bin

Securing wire mesh over vents discourages nuisance visitors.

Figure 2. Fully composted poultry litter.

Integrated Crop-Livestock Systems
Manure & Risk Reduction

- **Rotational Grazing or Pasture**
- Integration of sustainable practices such as the use of grazing animals in fields destined for produce may introduce additional food safety risks



Integrated Crop-Livestock Systems
Manure & Risk Reduction

- **Grazing animals, Working Animals and Animal Intrusion**
- Evidence of potential contamination of produce (during growing)?
- Yes (observation of animals, animal excreta or crop destruction)
  - Can be harvested or not based on measures taken during the growing and assessment of the risks/contamination at the harvesting (FSMA § 112.83)

Integrated Crop-Livestock Systems
Rotational Grazing - Sheep

Received: 15 September 2017 | Revised: 16 May 2018 | Accepted: 20 June 2018

DOI: 10.1111/zph.12503

SHORT COMMUNICATION

WILEY

Persistence of *Escherichia coli* in the soil of an organic mixed crop-livestock farm that integrates sheep grazing within vegetable fields

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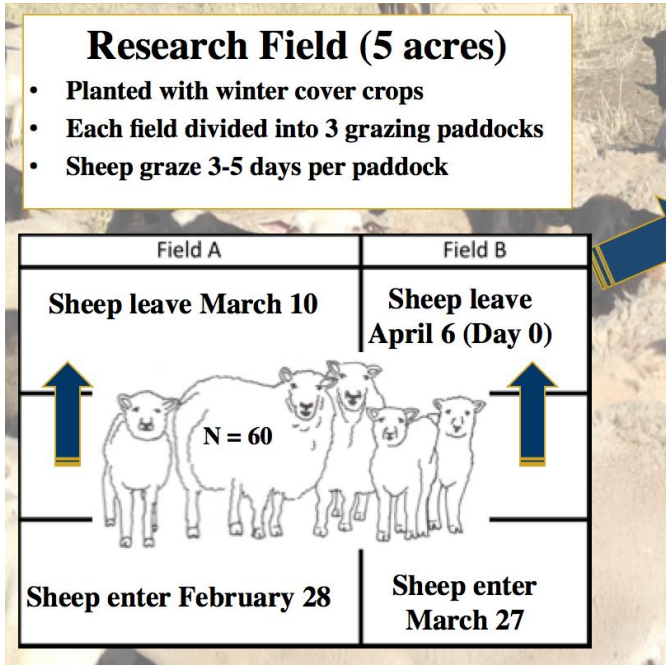
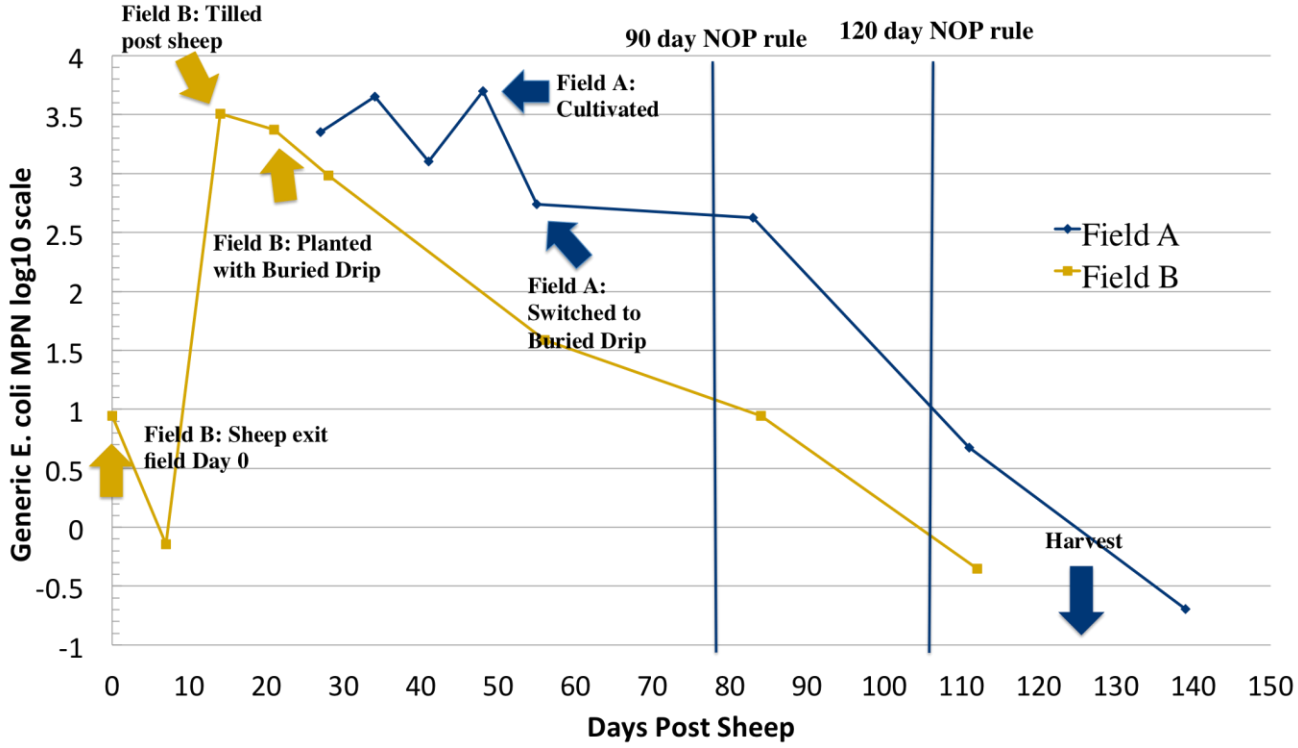
[1]Department Population Health and Reproduction, School of Veterinary Medicine, University of California-Davis, Davis, California

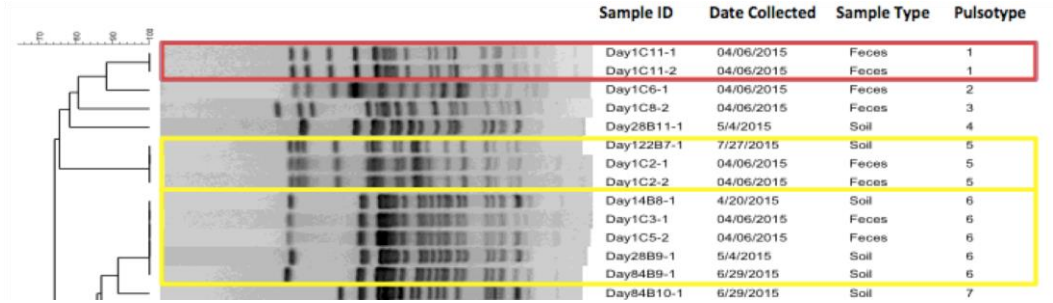
Abstract

Mixed crop-livestock farms (MCLF) integrate livestock and crops using their animals

Integrated Crop-Livestock Systems
Rotational Grazing - Sheep

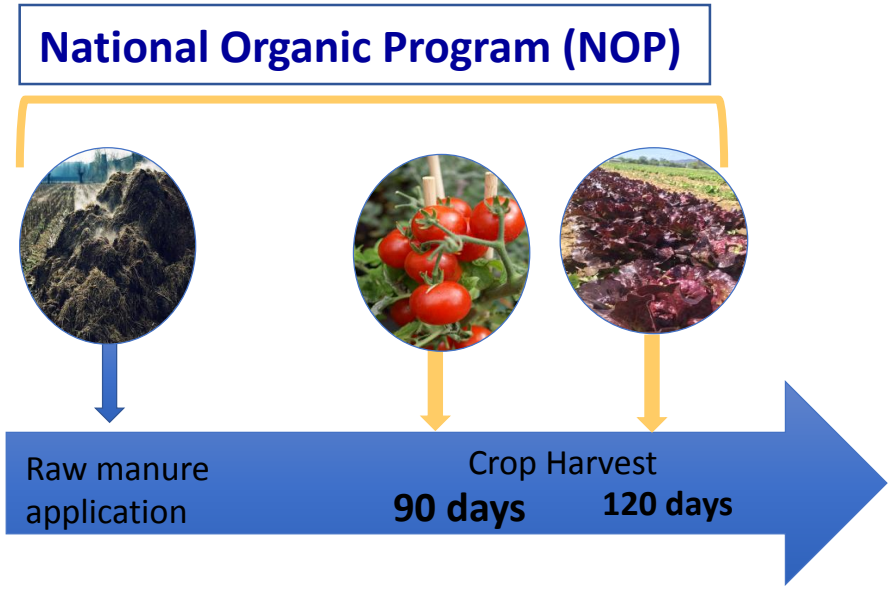






Integrated Crop-Livestock Systems
Rotational Grazing - Sheep

- **Grazing animals, Working Animals and Animal Intrusion**
- Farmers follow the NOP rule (90 & 120 Days)

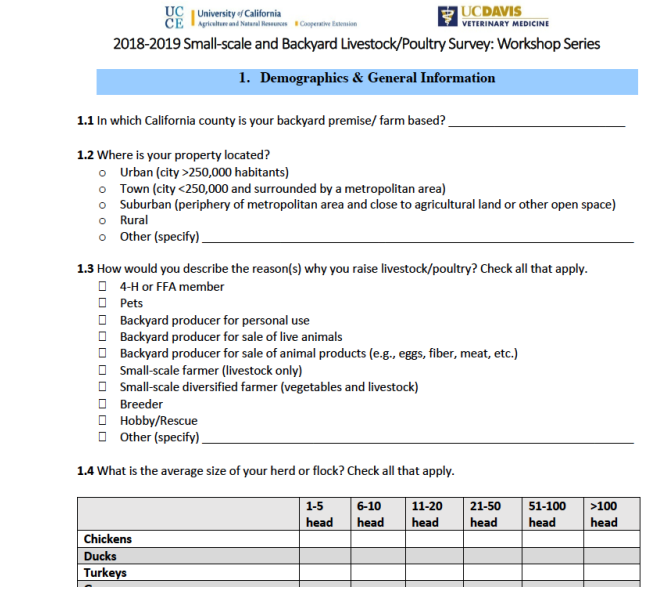


Manure & Risk Reduction
Record Keeping

- Developing a recordkeeping system to properly document the compost /manure treatment and applications and support a a farm food safety plan

- Type of soil amendment being applied
- Composting method: microbial testing (if applicable), turning times and temperature, feedstocks used,
- Date of application
- Rate (quantity applied per acre)
- Method of application
- What crops will be planted

Research
Current Survey



UC CE University of California Agriculture and Natural Resources Cooperative Extension — UCDAVIS VETERINARY MEDICINE

2018-2019 Small-scale and Backyard Livestock/Poultry Survey: Workshop Series

1. Demographics & General Information

1.1 In which California county is your backyard premise/ farm based? _____

1.2 Where is your property located?
- ○ Urban (city >250,000 habitants)
- ○ Town (city <250,000 and surrounded by a metropolitan area)
- ○ Suburban (periphery of metropolitan area and close to agricultural land or other open space)
- ○ Rural
- ○ Other (specify) _____

1.3 How would you describe the reason(s) why you raise livestock/poultry? Check all that apply.
- ☐ 4-H or FFA member
- ☐ Pets
- ☐ Backyard producer for personal use
- ☐ Backyard producer for sale of live animals
- ☐ Backyard producer for sale of animal products (e.g., eggs, fiber, meat, etc.)
- ☐ Small-scale farmer (livestock only)
- ☐ Small-scale diversified farmer (vegetables and livestock)
- ☐ Breeder
- ☐ Hobby/Rescue
- ☐ Other (specify) _____

1.4 What is the average size of your herd or flock? Check all that apply.

	1-5 head	6-10 head	11-20 head	21-50 head	51-100 head	>100 head
Chickens						
Ducks						
Turkeys						

UCDAVIS VETERINARY MEDICINE — University of California Agriculture and Natural Resources

2018-2019 Small-scale and Backyard Livestock/Poultry Survey: Workshop Series

What's in the survey?
- Evaluate and characterize the animal health and antimicrobial use in small-scale/ backyard livestock & poultry farms/premises.

Why conduct a survey?
- This survey will serve as a benchmark for designing effective education programs to train farmers and backyard owners working with livestock.

Who should participate?
- Small-scale and backyard livestock & poultry owners in California.

Where can I find the survey? https://ucdavis.co1.qualtrics.com/jfe/form/SV_8jMboTtv9LyabAx

You can visit the survey using this QR code:

Please feel free to contact Alda Pires (530) 754-9855; *apires@ucdavis.edu* with any questions
This study is funded by CDFA, contract # 17-0251

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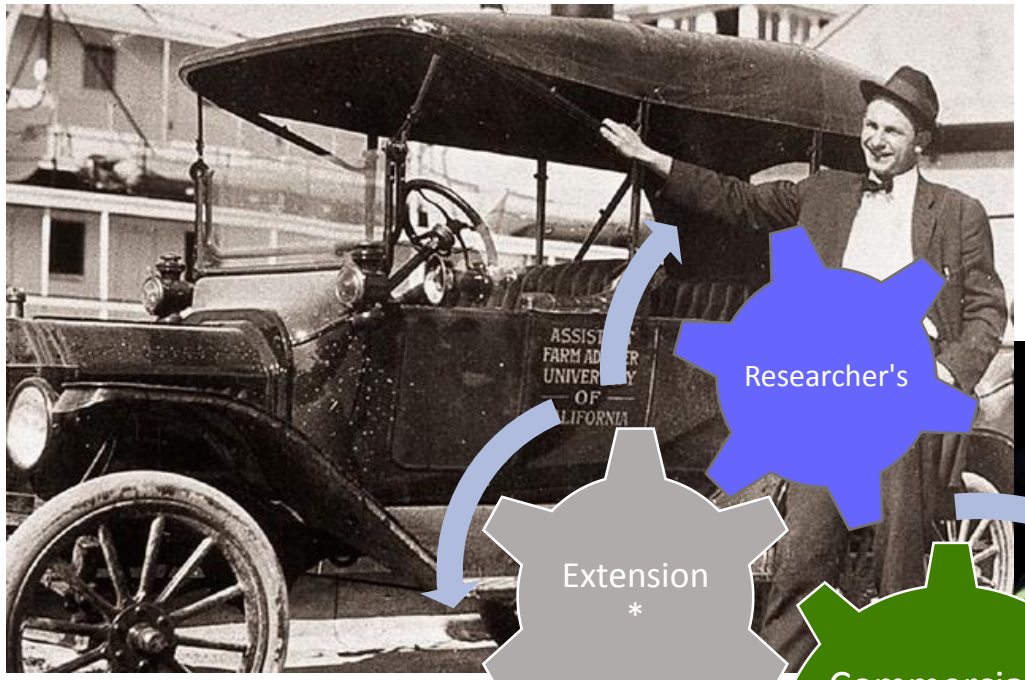
Healthy Animals, Healthy People Workshop

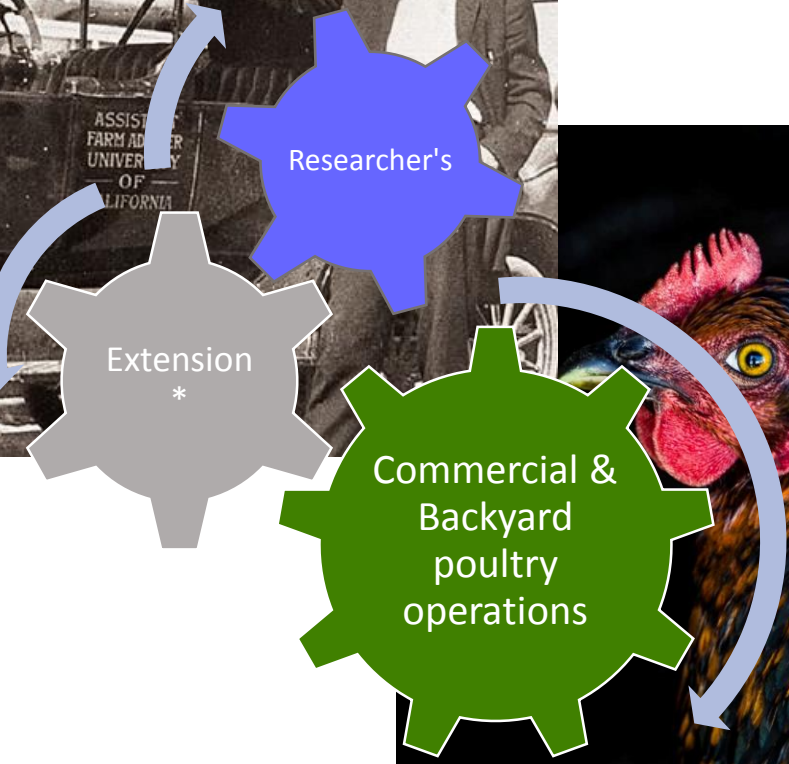
For more information about the material presented in this workshop, as well as additional resources, please visit the link below.
Thank you for attending!

https://ucanr.edu/sites/Small_Farms_/Events

- Online link https://ucdavis.co1.qualtrics.com/jfe/form/SV_8jMboTtv9LyabAx
- Thank you!

Thank you for your attention!





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Foodborne Pathogens

Proprieties of Composting Process to Control Foodborne Pathogens

http://cwmi.css.cornell.edu/smallscale.htm

Small Scale or Backyard Composting Resources

Small Scale or Backyard Composting web site - http://cwmi.css.cornell.edu/smallscale.htm

***Health and Safety Guidance for Small Scale Composting* fact sheet** - http://cwmi.css.cornell.edu/smallscaleguidance.pdf

Home Composting fact sheet - http://cwmi.css.cornell.edu/compostbrochure.pdf

NYS Small Scale Compost Demonstration Sites - http://compost.css.cornell.edu/maps.html#Holds_Demos=Yes

Compost: Truth or Consequences video - http://hdl.handle.net/1813/11313

Mixed Crop-Livestock Systems
Foodborne Pathogens & Pasture Poultry

Composting

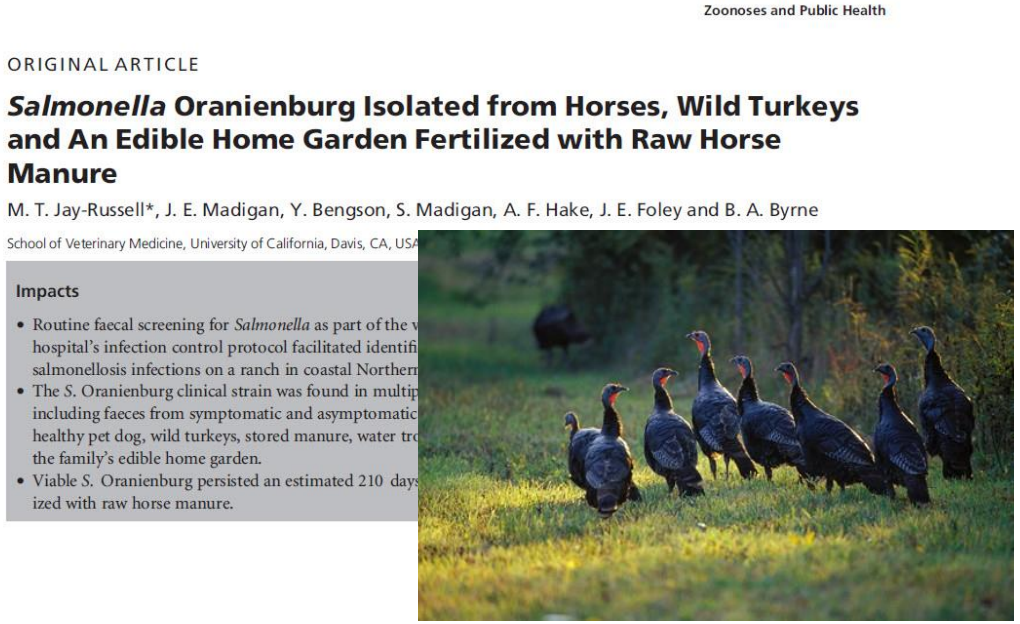
- *Enclosed or within-vessel composting*:
  - Active compost must maintain a minimum of 131 F for 3 days

- *Windrow composting*
  - Active compost must maintain aerobic conditions for a minimum of 131F or higher for 15 days or longer, with a minimal of 5 turnings during this period

- *Aerated static pile composting*
  - Active compost must be covered with at least 12 inches of insulating materials and maintain a minimum of 137F for 3 days
- **Enteric pathogen criteria (LGMA)** **FSMA**
- Fecal coliforms <1000 MPN/gram
- Salmonella negative / <1/30gram
- E. coli O157:H7 negative / <1/30gram

Wildlife Intrusions

- Wildlife animals can carry pathogens in their feces:
  - Rodents (gopher, ground squirrels, mice, rats)
  - Birds (wild turkeys)
  - Deer (ex: strawberry outbreak in Oregon)
  - Feral pigs (Salinas spinach outbreak 2006)
- Contamination car occur directly or indirectly (water & soil)



Zoonoses and Public Health

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

School of Veterinary Medicine, University of California, Davis, CA, USA

Impacts

- Routine faecal screening for *Salmonella* as part of the v hospital's infection control protocol facilitated identifi salmonellosis infections on a ranch in coastal Northern
- The *S.* Oranienburg clinical strain was found in multip including faeces from symptomatic and asymptomatic healthy pet dog, wild turkeys, stored manure, water tr the family's edible home garden.
- Viable *S.* Oranienburg persisted an estimated 210 days ized with raw horse manure.

Food Safety News

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Did Deer Cause Oregon's Strawberry Outbreak?

BY GRETCHEN GOETZ | AUGUST 9, 2011

Strawberries sold at roadside and farmer's markets last month in Oregon have been implicated in an outbreak of E. coli O157:H7 infection that has caused one death and sickened as many as 15 others, the Oregon Department of Public Health announced Monday.

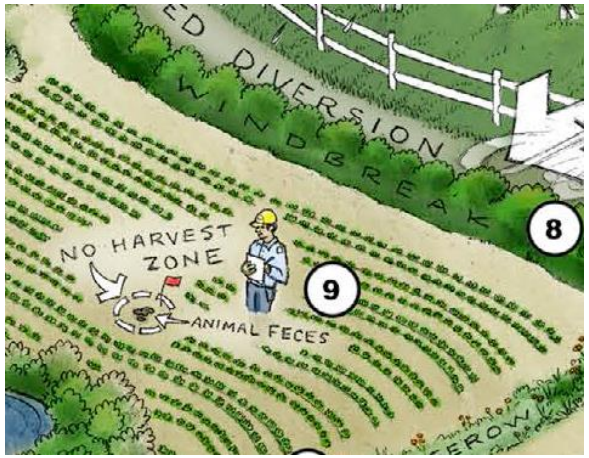
The outbreak sent four people to the hospital and two suffered hemolytic uremic syndrome. One, an elderly woman from Washington County, died from kidney failure caused by the disease.

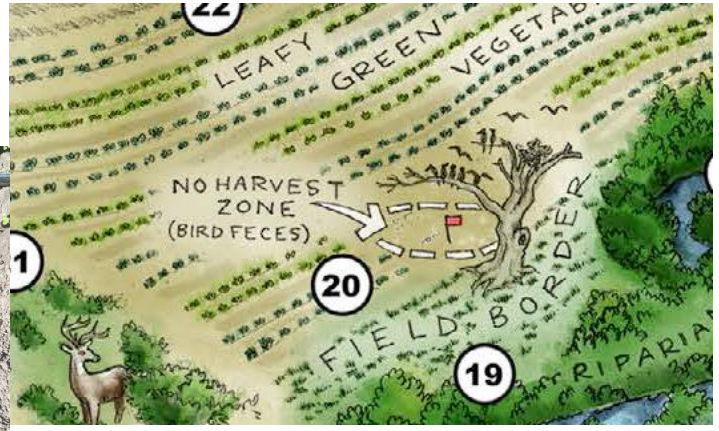
So far, health investigators think deer may be to blame for the E. coli contamination. Deer tracks and deer feces were observed in several strawberry fields at the suspect farm, according to health investigators.

Tracing the berries to that farm was no easy task. Between July 10 and 29, at least 10 and as many as 16 people fell ill in Oregon with E. coli O157:H7 infections. It was not until last week – when genetic

Manure & Risk Reduction

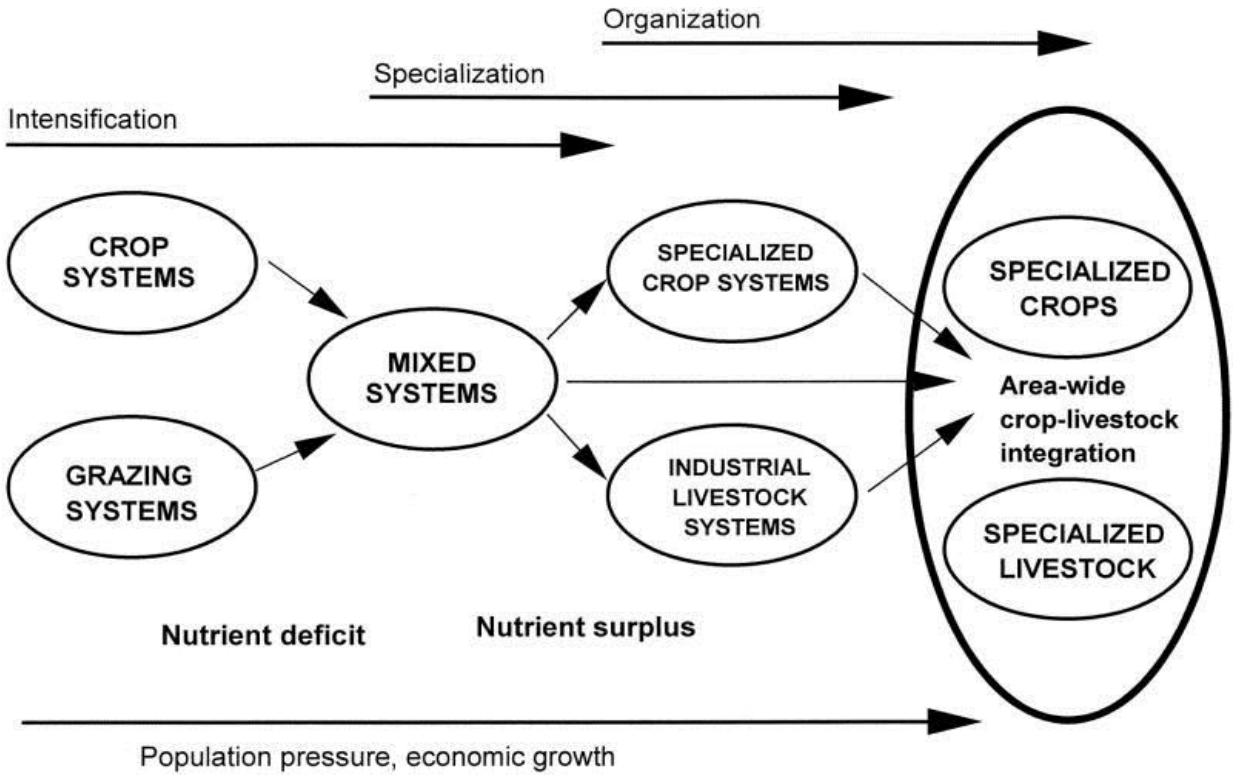
- Contaminated crops by wildlife intrusions





(Adapted from Co-Managing Farm Stewardship with Food Safety GAPS Conservation Practices, Wild Farm Alliance, 2016)

Livestock on Diversified Farms:
Integrated Crop-Livestock Systems



Pathways of crop-livestock integration

Adapted Steinfeld, 1998

Evaluation of the prevalence and persistence of Shiga toxin-producing *Escherichia coli* (STEC) on organic mixed crop-livestock farms that integrate sheep grazing within vegetable fields

- **Preliminary Data:** Year 2 (On-Farm)
- Crops: Tomatoes
- Field A& B: grazed by sheep; Field C: non- grazed
- **STEC:** 87.5% fecal samples, 13.2% soil

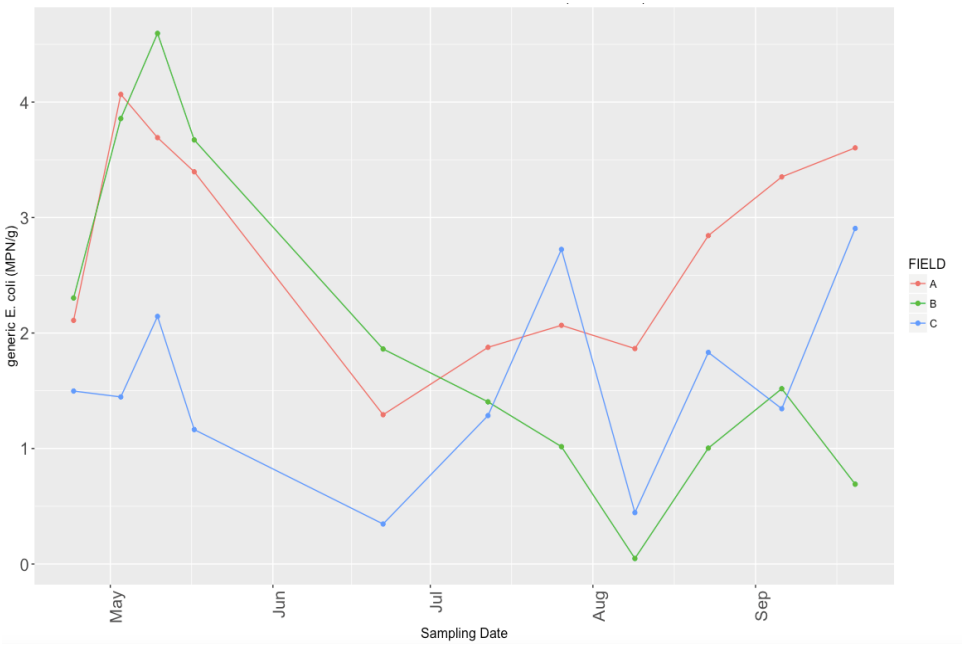
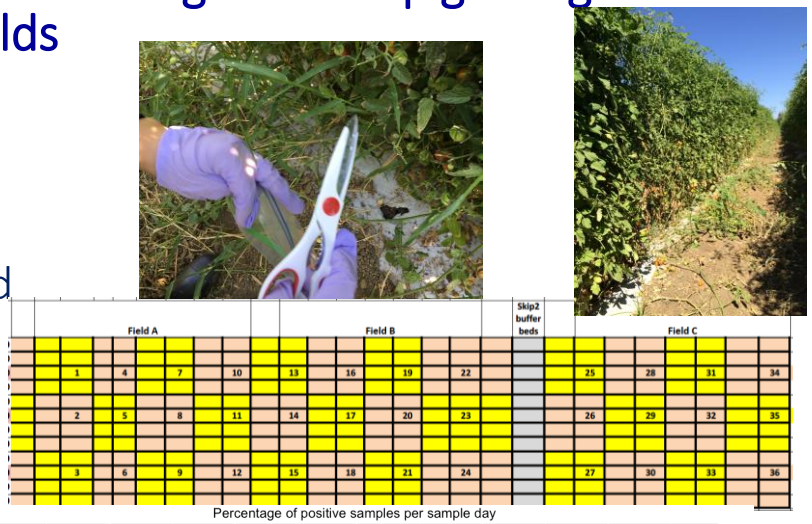


Figure 1: *The average number of generic* E. coli *in soil samples (MPN/gram) per sampling day for fields A, B and C (field C = control non- grazed field).*



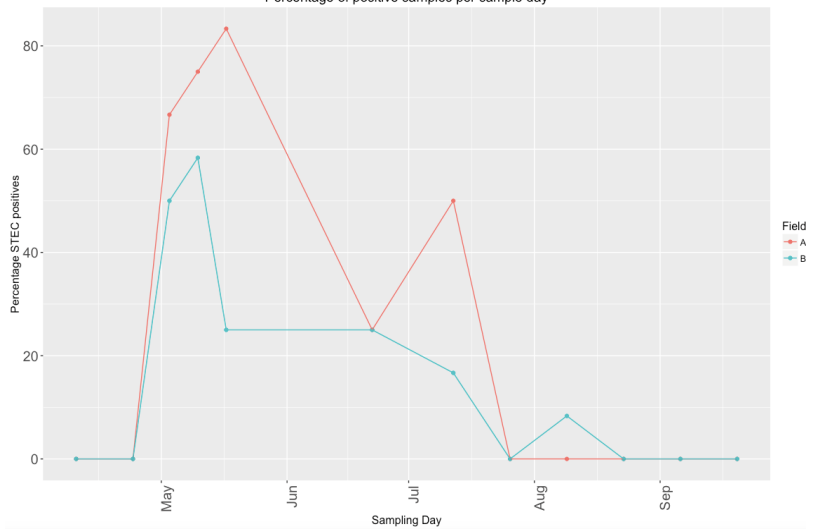


Fig 2: *Percentage of non-O157 STEC positive soil samples per sampling day for fields A & B*

Evaluation of the prevalence and persistence of Shiga toxin-producing *Escherichia coli* (STEC) on organic mixed crop-livestock farms that integrate sheep grazing within vegetable fields

- **Preliminary Data:** Year 3 (Field Trials-Sheep Barn)






Evaluation of the prevalence and persistence of Shiga toxin-producing *Escherichia coli* (STEC) on organic mixed crop-livestock farms that integrate sheep grazing within vegetable fields

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