Animal Husbandry in Urban Agriculture

Food Safety Basics for Urban Farmers
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Background

Food Animal Clinician (small - large - scale farms) and Lecturer, Portugal & UC Davis

Veterinary Epidemiologist (Food Safety & Epidemiology of Infectious Diseases), MSU & UC Davis

Urban Agriculture & Food Safety, Extension Specialist, School of Veterinary Medicine, UC Davis
Goat Herd Characteristics

- Dairy, Meat, Fiber, Brush clearance, Packing, Biomedical use, Companion

Commercial producer
Seedstock breeder
Family/small herd
Youth 4H/FFA project
Individual pets

Slide courtesy of Dr. Rowe
What is the desired product?

Milk, Cheese, Market Kids, Fiber, Ability to Browse/Travel, Companionship

Slide courtesy of Dr. Rowe
Animal & Herd Health

- **Animal Husbandry**: ‘a branch from agriculture concerned with the production and care of domestic animals’
- **Good Husbandry Practices**

https://en.wikipedia.org/
Animal & Herd Health

Housing

• Space available
  – Barn/Coop
  – Pasture
• Appropriate shelter
• Ventilation (respiratory diseases)
• Feeding Facilities
• Watering facilities
• Separation of animals by age groups
• Protection from predators/wildlife (fencing)
• Cleaning and sanitation of the barn and equipment
Animal & Herd Health

Predator Prevention

Fencing
Housing
Guardian Animals
Pets as predators

Mortality- adult & kid
Pregnancy loss
Welfare

Slide courtesy of Dr. Rowe
Animal & Herd Health

**Disease Control**

Management measures taken to prevent disease agents from being introduced and spreading to and/or from animal populations or their proximity (biosecurity)

- **ISOLATION/ ADDITIONS:** confinement of animals away from other animals
- **TRAFIC CONTROL:** movement of people, animals, and equipment
- **SANITATION/HUSBANDRY:** cleanliness and care of animals and their environment
- **PEST CONTROL:** Rodents
Transmission Routes

Introduction of Diseases and Transmission

There are multiple hosts and multiple routes of Transmission

(Adapted from www.cfsph.iastate.edu/BRM)
Disease Control

Animal Additions

• **Health status** of the source flock/herd(s)
  • Commercial Herd/Flock
  • Hatcheries
  • Breeder
  • Neighbor
  • Feed Stores

• Number of animal sources should be minimized

• **High Health Herd:** Regularly monitors for diseases in the herd and keeps records

Photos courtesy of Dr. Rowe
Disease Control

Animal Additions

• Quarantine
  – Isolate new animals **for 30 days** (at least **15 days**)
  – Isolation areas

• Time for:
  – **Observation of the animals**: signs of disease
  – **Testing for diseases** of concern
  – **Preventive Health**
    • Vaccination
    • Deworming

• **Uniform age groups**
Disease Control
Record Keeping

- New Additions
- Individual/Group Disease Events
- Feed changes
- Reproductive Records (breeding, kidding)
- Production records
- Body Condition Scores
- Disease Test Results
  - Fecal tests
  - Diagnostic lab reports

Adapted from http://www.oakhillhomestead.com
Disease Control

Traffic Control

Movement of people, animals and equipment

- People & Equipment can carry pathogens
- Avoid exposure of the owner/employees to other flocks or other livestock

- Q Fever, CAE, CL, Orf, Toxoplasma, foodborne pathogens
Disease Control

Traffic Control & Sanitation

• Visitors
  • Restrict access visitors (e.g., barns, pastures, kidding areas)
  • Strict sanitation standards

Vehicles
  • Clean and disinfect your vehicle after returning from events (fairs/shows)
Disease Control

Traffic Control & Sanitation

- Wear personal protective equipment (PPE) when handling animals
  - Gloves
  - Dedicated clothing (coveralls) & boots
  - Footbath (?) or bucket w scrub brush
- Different PPE to handle animals and vegetable garden
- Wash hands after removing outwear, gloves, boots
Disease Control

Traffic Control & Sanitation

• **Q Fever** (Coxiella burnetii) Ubiquitous & persistence in the environment

Volunteers will be used to cuddle, feed goats at Virginia farm

An Albemarle County farm is using volunteers to snuggle their baby goats.

Media outlets report that **Carmont Farm in Forest** expects 90 baby goats, 1 kids, will be born by mid-February.

The farmers make goat cheeses, so 24-hours after the kids are born the farm starts bottle-feeding the babies and milking the mothers. The kids have to be bottle-fed four times a day.

Farm 7 soil and vacuum samples collected in JUN2011

Kersh et al., 2013
Disease Control

Sanitation

Equipment & Facilities

• Sources of infection
• Clean and disinfect equipment and avoid sharing equipment & feed from neighbor/healthy & sick Animals
Disease Control

**Sanitation: Cleaning & Disinfection**

1. **Pre-Cleaning Removal of debris (aka remove the dirt)**
2. **Apply soap (aka wet the dirt with a foamy soap)** - 80%
3. **Wash the dirt away**
4. **Let the surface drain and dry**
5. **Apply disinfectant (Right disinfectant, concentration, consistency, time)** - 20%

(Slide courtesy of Dr. Maurice Pitesky)
Disease Control

Sanitation: Cleaning & Disinfection

• Dilute chlorine bleach most common agent
  • Between 65 and 200 ppm
    • 1 tablespoon bleach per gallon water = 200 ppm (max for sanitizing food contact surfaces)

Table 1 – Amount of chlorine bleach per gallon of water for a given chlorine concentration

<table>
<thead>
<tr>
<th>Amount of chlorine bleach per gallon of water</th>
<th>Approximate concentration of total chlorine (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 teaspoon</td>
<td>65</td>
</tr>
<tr>
<td>1 tablespoon</td>
<td>200</td>
</tr>
<tr>
<td>1 fluid ounce</td>
<td>400</td>
</tr>
<tr>
<td>1/4 cup</td>
<td>800</td>
</tr>
<tr>
<td>1/2 cup</td>
<td>1600</td>
</tr>
<tr>
<td>2/3 cup</td>
<td>2200</td>
</tr>
<tr>
<td>3/4 cup</td>
<td>2400</td>
</tr>
<tr>
<td>1 cup</td>
<td>3200</td>
</tr>
</tbody>
</table>

1. Assuming 5.25% sodium hypochlorite in chlorine bleach.
2. Typically present as both hypochlorous acid and hypochlorite ion.
3. ppm = parts per million.

(McGlynn, FAPC-116)
## Characteristics of Selected Disinfectants

<table>
<thead>
<tr>
<th>Disinfectant Category</th>
<th>Alcohols</th>
<th>Aldehydes</th>
<th>Biguanides</th>
<th>Halogens: Hypochlorites</th>
<th>Halogens: Iodine Compounds</th>
<th>Oxidizing Agents</th>
<th>Phenols</th>
<th>Quaternary Ammonium Compounds (QAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample Trade Names</strong></td>
<td>Ethyl alcohol, Isopropyl alcohol</td>
<td>Formaldehyde, Glutaraldehyde</td>
<td>Chlorhexidine, Nolvasan, Virisan</td>
<td>Bleach</td>
<td>Betadyne, PROVIDONE</td>
<td>Hydrogen peroxide, Peroacetic acid, Virkon S, Oxy-Sept 333</td>
<td>One-Strore Environ, Pheno-Tek II, Tek-Trol</td>
<td>Roccal, DiQuat, D-256</td>
</tr>
<tr>
<td><strong>Mechanism of Action</strong></td>
<td>Precipitates proteins, Denatures lipids, Denatures proteins</td>
<td>Denatures proteins, Alkylates nucleic acids, Alters membrane permeability</td>
<td>Denatures proteins</td>
<td>Denatures proteins</td>
<td>Denatures proteins and lipids</td>
<td>Denatures proteins, Alters cell wall permeability</td>
<td>Denatures proteins, Binds phospholipids of cell membrane</td>
<td></td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
<td>Fast acting, Leaves no residue</td>
<td>Broad spectrum</td>
<td>Broad spectrum, Short contact time, Inexpensive</td>
<td>Stable in storage, Relatively safe</td>
<td>Broad spectrum</td>
<td>Good efficacy with organic material, Non-corrosive, Stable in storage</td>
<td>Stable in storage, Non-irritating to skin, Effective at high temperatures and high pH (9-10)</td>
<td></td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
<td>Rapid evaporation, Flammable</td>
<td>Carcinogenic, Mucous membranes and tissue irritation, Only use in well ventilated areas</td>
<td>Only functions in limited pH range (5-7), Toxic to fish (environmental concern)</td>
<td>Inactivated by sunlight, Requires frequent application</td>
<td>Damaging to some metals</td>
<td>Can cause skin and eye irritation</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Precautions</strong></td>
<td>Flammable, Carcinogenic, Never mix with acids; toxic chlorine gas will be released</td>
<td>May be toxic to animals, especially cats and pigs</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### Vegetative Bacteria
- Effective
- Effective
- Effective
- Effective
- Effective
- Effective
- Effective
- YES—Gram Positive, Limited—Gram Negative

### Mycobacteria
- Effective
- Effective
- Variable
- Effective
- Effective
- Variable
- Variable

### Enveloped Viruses
- Effective
- Effective
- Limited
- Effective
- Effective
- Effective
- Variable

### Non-enveloped Viruses
- Variable
- Effective
- Limited
- Effective
- Limited
- Effective
- Variable

### Spores
- Not Effective
- Effective
- Not Effective
- Variable
- Limited
- Not Effective
- Not Effective

### Fungi
- Effective
- Effective
- Limited
- Effective
- Variable
- Effective
- Variable

### Efficacy with Organic Matter
- Reduced
- Reduced
- ?
- Rapidly reduced
- Rapidly reduced
- Variable
- Effective
- Inactivated

### Efficacy with Hard Water
- ?
- Reduced
- ?
- Effective
- ?
- ?
- Effective
- Inactivated

### Efficacy with Soap/Detergents
- ?
- Reduced
- Inactivated
- Inactivated
- Effective
- ?
- Effective
- Inactivated

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**Disclaimer:** The use of trade names does not in any way signify endorsement of a particular product. For additional product names, please consult the most recent Compendium of Veterinary Products.

Disease Control

Pests Control: Rodents

• **Rats and Mice** carry diseases that can affect livestock, poultry, pets and humans (*Salmonella*, *Leptospira*, rat bite fever, etc.)

• **Mice and rats** have different behaviors

• **Rats** (Norway Rat & Roof Rats, different habitats) are more cautious, more opportunistic and have a larger geographical range of land

• **Spilled feed** will attract rats, mice, insects and birds

• **Management of Rats & Mice**: Sanitation, Building Construction and Population Control

http://ipm.ucanr.edu/
**Disease Control**

**Pests Control: Rodents**

- To get rid of rats/mice, remove food, water, and shelter, and seal entryways
  - Feed pets only the amount of food they will eat at a single feeding or bring food inside at night.
  - Keep garbage, trash, and garden debris in receptacles with tight-fitting lids.
- **Habitat Control**: Thin dense vegetation (shrubs, climbing hedges, tree limbs)
- Seal all cracks and openings (house, barns, coops, etc.)
- Put **traps or bait stations** every **25 to 50 feet** around the perimeter of the house
- Put traps along **beams, walls and ceiling routes** and at each **door**
Disease Control

Pests Control: Rodents

- **Ground Squirrels** cause damage by:
  - Eating food-bearing & ornamental plans
  - gnawing on plastic sprinklers and irrigation lines
  - burrowing (trip hazards and damages landscapes & structures)
- Carry diseases that can affect livestock, poultry, pets and humans (*Salmonella, Leptospira*, rat bite fever, plague etc.)
Disease Control

**Pests Control: Rodents**

- **Management of Ground Squirrels:** Traps, Fumigation and Toxic baits (depending on level of infestation, season and resources available)

Disease Control

Pests Control

UC IPM: [http://ipm.ucanr.edu/PMG/menu.house.html#STING](http://ipm.ucanr.edu/PMG/menu.house.html#STING)
Goat Herd Health

- Ration formulation
- Feeds available
- Body condition assessment
- Feedbunk & Water management

Nutrition
- Space
- Shelter
- Ventilation
- Fencing
- Sanitation

Infectious Disease Control
- Mycoplasma
- CAEV
- CLA
- Johnes
- (Scrapie)
- Abortion agents

Protocols
- Vaccination
- Deworming
- Kidding / Doe
- Milk Quality
- Culling
- Disease Diagnosis & Treatment

Prevention
Veterinary-Client – Patient Relationship (VCPR)

Photos courtesy of Dr. Rowe
Goat Herd Health

Veterinary-Client-Patient-Relationship (VCPR)

• Essentially means that the veterinarian is familiar with the client and his livestock

• Allows the veterinarian to write a prescription for medications, without actually examining every sick animal

• Keeping medications on hand allows prompt treatment of sick animals

Slide Courtesy of Dr. Bauman
Zoonotic Diseases

• Zoonoses:
  • are diseases or infections naturally transmissible directly or indirectly between animals and humans
• 70% of human infections diseases are zoonotic

Adapted from: http://n2gf.com/
Foodborne Diseases

Some definitions

- **Foodborne Pathogens**: a biological infectious agent (bacteria, virus, parasites) that causes foodborne illness to host (food poisoning)
- **Food poisoning** is any illness resulting from consumption of contaminated food

**Bacteria:**
- *Campylobacter*
- *Salmonella*
- *E. coli* O157:H7
- *E. coli* non–O157 STEC
- *Listeria monocytogenes*
- *Shigella*
- Staphylococcus

**Virus:**
- Noravirus
- Rotavirus
- Hepatitis virus

**Parasites:**
- Cryptosporidium
- Cyclospora
- Toxoplasma
- Trichinella

Adapted from CDC, NARMS
Foodborne Diseases

Introduction of Foodborne Pathogens in produce crops
Foodborne Diseases

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)

Adapted from CDC,NARMS

- *Salmonella*
- *Campylobacter*
- *E. coli O157:H57*
- *Salmonella*
- *Campylobacter*
Foodborne Diseases

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
Foodborne Diseases
Manure & Risk Reduction

Soil

- Enteric Pathogens can persist for long periods in the soil:
  - *Salmonella* can persist in the litter applied to fields 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 Diseases

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 can occur directly or indirectly (water & soil)
Foodborne Diseases

Wildlife Intrusions

• Prevention of Contamination
  • Integrated Pest Management (IPM)
  • Fencing of the vegetable garden (wildlife & pets)
  • Composting bins (avoid meat/fatty products)
  • Animals, manure and vegetable crops well separated
  • Co-management
• Co-management
• encourage the application of practices that can enhance food safety and that are also consistent with sustainable conservation

Adapted from Wild Farm Alliance 2017, A Grower's & Conservationist's Handbook
• **Contaminated Crops**
• What to do?

**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)
- Contaminated Crops
- Buffer zones
- No harvest

Adapted from Wild Farm Alliance 2017, A Grower’s & Conservationist’s Handbook
References

• Small Farms & Urban Animal Agriculture
  http://ucanr.edu/sites/Small_Farms/

• Pests Control
  – http://ipm.ucanr.edu/PMG/menu.vertebrate.html
  – http://ipm.ucanr.edu/PMG/menu.house.html#STING

• Animal Husbandry

• Zoonoses & Disinfection
  http://www.cfsph.iastate.edu/Zoonoses/index.php
  http://www.cfsph.iastate.edu/Disinfection/index.php

• Co-management
  – http://ucfoodsafety.ucdavis.edu/Preharvest/Co-Management_of_Food_Safety_and_Sustainability/
  – http://www.wildfarmalliance.org/food_safety_and_conservation_resources
Thank you for your attention!

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http://ucanr.edu/sites/Small_Farms_/
Populations at higher risk

- Children (< 5 years)
- Older persons
- Weaken immune system (immunocompromised, chemotherapy)
- Pregnant women

- People without previous livestock exposure more at risk (may not have immunity)

(Adapted from www.cfsph.iastate.edu/BRM)
Human-Animal Interaction

- Animal may not show obvious signs of illness
- Disease risk cannot be totally eliminated
  - Animals & its environment
  - Decrease exposure
  - Infectious agent interactions
  - Many routes of transmission
- Identify risk areas or risky behaviors
- Minimize the threat to animals and humans

Adapted from: http://n2gf.com/