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Composting of Poultry Offal Demonstration Project

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Objectives
Develop a successful composting process of poultry offal to produce finished compost that is environmentally sound, economically feasible, and returns nutrients to the farm. Compare compost made from materials produced on Lopez Island to compost made from traditional composting materials that are imported to the island. Compare efficacy of composting as well as costs.

Introduction

- Small-scale poultry production can be profitable for farmers but how do you deal with the slaughter waste (offal, guts, feet, heads, and feathers)?
- Composting has been used to compost chicken moralities across the nation.
- Costs of off-island materials for composting are expensive.
- Can composting be used on Lopez Island to treat offal?
- Can local materials be used for composting?

Procedures

On-Farm composting methods**:** Static piles with passive aeration: 4-5 inch diameter black plastic drain pipe with pre-drilled holes drilled 8 inches apart on 2 sides of the pipe.

1. Compost materials description:

Offal: Guts, feet, heads and feathers produced after chicken slaughter at Middle Farm, Lopez Island.

On-island compost materials
Road trimmings: Coarse wood chips produced from clean-up of brush and tree waste trimmed from road right-of-ways on Lopez Island.

Shredded paper: Paper waste collected from local businesses on Lopez Island.
Chicken bedding: Collected from the chicken houses at Middle Farm, Lopez Island.

Off-island compost materials
Wood shavings: Saw waste from regional mills off-island.

TABLE 1. Carbon (C), Nitrogen (N), moisture (%), and bulk density (lb/yd and lb/gal) of materials used for composting.

	Total C	Total N	C: N	Moisture	Bulk Density	
	%	%		%	lb/yd	lb/gal
Road trimmings	56	0.42	134	53	539	2.67
Shredded paper	51	<1	2956	5	110	0.54
Used chicken bedding	43	2.04	21	15	371	1.84
Wood shavings	58	<1	3037	33	168	0.83
Offal	55	10-12	5.2	86	533	2.64

2. Final mixtures
   On-Island compost made from road trimmings, used chicken bedding, shredded paper, and offal: C:N of 22, solids content 50%
   Off-Island compost made from wood shavings and offal: C:N of 19, solids content 60%

3. Materials
   Offal, feet, heads and feathers from 150 chickens plus off-island or on-island bulking agents:

TABLE 2. Amounts of bulking agents (gallons) used for composting poultry offal.

Off-Island		On-Island	
Wood shavings	240 gal	Road trimmings	156 gal
		Used chicken bedding	30 gal
		Shredded paper	5 gal

We constructed 2 composting bins; one bin was used for each of the two compost mixtures. Bins were 4 ft wide by 8 ft long by 5 ft high, and were side by side. Approximately 2000 chickens were slaughtered over the course of this study, and all offal was added to the compost bins. At each time of slaughter, offal was added to one bin, and additions alternated between the bins.

Composting Temperatures Active composting requires temperatures between 110° and 150° F. Pathogen destruction occurs if temperatures are greater than 131° F for at least 3 days. In this study, temperatures were above 131° F for no less than 7 days at a time, and for up to 30 days.

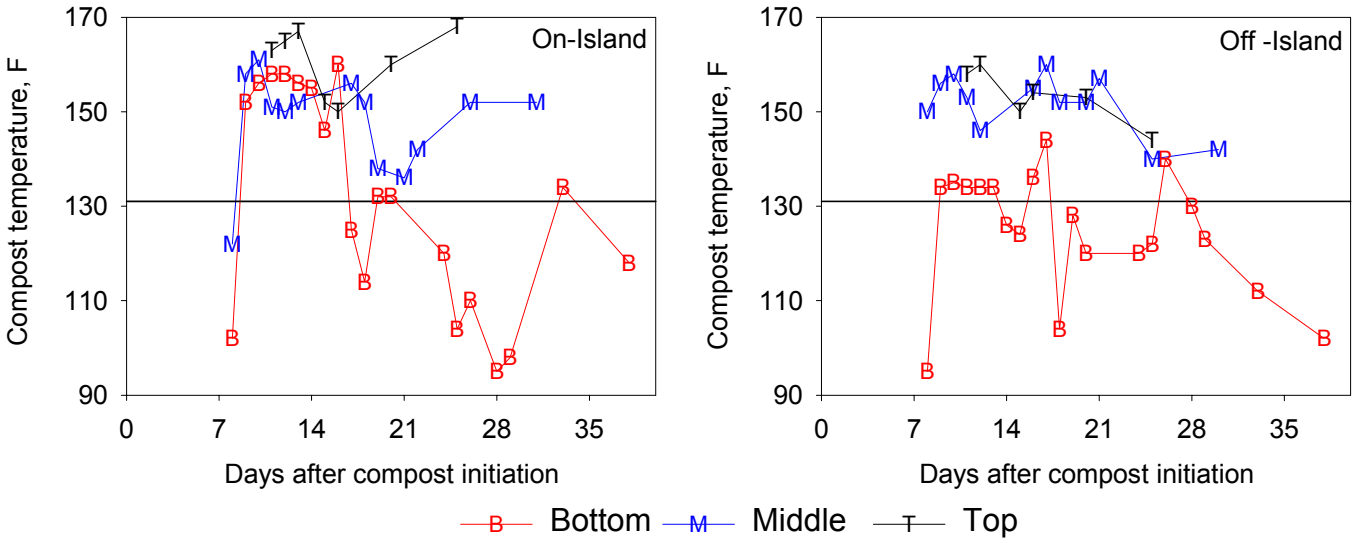

Figure 1. Temperature (°F) over the course of the study (35 days) in the bottom (B), middle (M), and top (T) of the compost made from on-island and off-island materials.

Pathogen reduction – In this study we showed that composting resulted in a 97% reduction in *Escherichia coli* population.

TABLE 3. Pathogen reduction by composting observed in this study.

Raw Offal	After composting
E coli 62,000 E coli/gram	E coli 0-63 E. coli/gram
No Salmonella detected	No Salmonella detected

Odors Slight odors were noticed adjacent to piles when offal was handled the same day it was produced.

Costs

TABLE 4. Costs of composting materials.

Item	On-island materials	Off-island materials
Wood shavings		$289
Wood shavings delivery		$300
2 temperature probes (36 inches long)	$111	$111
Bin construction materials Posts, wire, fencing, etc	$84	$84
Road trimmings	FREE	
Shredded paper	FREE	
Used chicken bedding	FREE	

http://agsyst.wsu.edu/poultryOffal.pdf

TOTAL COST	**$195**	**$784**

Conclusions

- Composting can be used successfully for managing chicken offal.
- During this poultry offal composting demonstration, we observed a 97% reduction in coliforms and generic *E. coli*.
- Compost quality is still to be determined.
- Cost is significantly less if appropriate bulking agents can be utilized from on-island sources.

The Composting Process

Composting is the controlled aerobic decomposition of organic materials.

Factors that affect composting for optimal conditions

1. Carbon to Nitrogen Ratio – Optimal C:N is 25 to 30:1

TABLE 1. Carbon (%C), nitrogen (%N), moisture (%) and bulk density (lb/yd and lb/gal) of common composting materials and materials used for Lopez Island Poultry Offal Composting Study.

	Total C %	Total N %	C:N	Moisture %	Bulk density (dry weight basis)	
					Lb/yd	Lb/gal
Woody roadway trimmings	56	0.4	134	53	539	2.7
Shredded paper	51	<0.1	3000	5	110	0.5
Wood shavings	58	<0.1	3000	33	168	0.8
Offal	55	10-12	5.2	86	533	2.6
Chicken bedding	43	2.04	21	15	371	1.84
Broiler manure	38	2.7	14	37	864	4.3
Sheep manure	43	2.7	16	69	-	-
Cow manure	49	2.7	18	79	1400	6.9
Grass clippings	50	2-6	9-25	82	600	3.0
Leaves	50	0.9	54	38	300	1.5
Bark	70	0.14	496	-	-	-

2. Oxygen and aeration

- Composting consumes large amounts of oxygen
- Air contains 21% oxygen
- Need greater than 5% oxygen in pile for aerobic conditions
- If pile becomes anaerobic, different micro-organisms with different processes dominate, and results may include odors and non-composting activity

3. Moisture

- Moisture is needed for favorable micro-organism survival
- Optimal 50-60% moisture
- If pile is too dry, organisms die
- If pile is too wet, not enough oxygen supply for organisms

4. **Porosity, structure and particle size**
    - Porosity and other physical factors limit air and oxygen movement in the pile
    - Bulking agents may need to be added to increase porosity - materials that add porosity are yard trimmings, wood shavings, etc.
    - Proper mixing

5. **Temperature**
    - Thermophilic – 110-150 ^{o} F for active composting
    - Pathogen destruction
      131 ^{o} F for > 3 days combined with turning or aeration generally destroys pathogens
    - 145 ^{o} F will kill weed seeds
    - Temperatures above 160 ^{o} F causes shift in micro-organism populations

6. **pH**
    - Optimal between 6.5-8.0
    - Not usually a problem

7. **Time**
    - Length of time needed for degradation depends on all of the above factors and end use

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