

Unit C: Poultry Management

Lesson 4: Poultry Waste Management

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Discuss the importance of managing poultry waste.
2. Determine the appropriate waste management system for a poultry operation.
3. Utilize poultry waste as fertilizer.

Recommended Teaching Time: 3 hours

Recommended Resources: The following resources may be useful in teaching this lesson:

- A PowerPoint has also been developed for use with this lesson plan
- <http://www.agr.gc.ca/volaille/manure.pdf>
- <http://msucares.com/pubs/publications/p1878.htm>
- <http://edis.ifas.ufl.edu/aa205>

List of Equipment, Tools, Supplies, and Facilities

Writing surface
PowerPoint Projector
PowerPoint Slides
Transparency Master copies
Colored pencils, markers or crayons (optional)
Paper

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide # 2):

Aerobic
Anaerobic
Composting
Dehydration
Digester
Incineration
Nitrates

Interest Approach: Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Remind the students what has been discussed in the previous lessons- poultry health, housing, feeding, management, etc. Tell the students, “When poultry are fed, they produce large amounts of manure. What do you think is done with this manure?” Have the students raise their hand and share their answers. Use their answer to move into the content.

Summary of Content and Teaching Strategies

Objective 1: Discuss the importance of managing poultry waste. (PowerPoint Slide #3)

- I. After proper feeding and health are taken care of, a poultry producer then needs to worry about the waste produced by the birds.
 - A. Poultry wastes can affect your health, water quality, and the water quality and health of others if it is not handled properly.

(PowerPoint Slide #4)

1. Bacteria in animal wastes can contaminate drinking water and may cause potentially serious illnesses.
2. High levels of **nitrates**, a form of nitrogen that develops naturally in animal wastes, in drinking water may particularly harm unborn or young infants and young livestock.
3. Nutrients in animal wastes that enter streams also may lower oxygen levels and kill fish and other wildlife.
4. Odors from animal operations may cause problems with neighbors and create a negative public perception of agriculture.

(PowerPoint Slide #5)

- B. Proper animal waste management reduces these concerns.
 1. Animal wastes also are an important source of plant nutrients for crop production.
 2. Other aspects of poultry production, such as how the carcasses are disposed of also may contaminate water by introducing bacteria or nitrates.

(PowerPoint Slide #6)

- C. To protect water quality, your animal waste management system should be properly designed, built, and maintained.
 1. At a minimum, your animal waste lagoon, animal waste storage area, or animal waste land application area should be at least 30 meters from a private well or other water source, and preferably farther away if possible.

(PowerPoint Slide #7)

2. You should also apply animal wastes to growing crops or pastures when possible and according to approved application rates.
3. Animal waste land applications also should be 0.3 kilometers or farther from other residences.
4. Cover any animal wastes transported on public roads to avoid possible pollution.

Ask the students if they have ever encountered unpleasant odors from a poultry farm. Discuss with the students the importance of properly handling the waste. Ask them what perceptions the public might have about poultry waste and its odor. Discuss with them the steps that can be taken to ensure positive public perceptions of poultry operations.

Objective 2: Determine the appropriate waste management system for a poultry operation.

(PowerPoint Slide #8)

- II. Choosing a proper waste management system will depend upon many factors such as size of operation, type and number of birds and even climate. There is not a “perfect” system for waste management. Ultimately the decision must be made on the cost to the producer.
 - A. Anaerobic and aerobic processing of poultry waste can be done in two ways, lagoons and digesters.

(PowerPoint Slide #9)

- B. **Anaerobic** means bacteria consume manure in the absence of oxygen.
 1. Lagoons are the first method.
 - a. The poultry waste is placed in a large pond or “lagoon”.
 - b. Bacterial activity then reduces the solids and liquefies it.
 - c. This method causes lots of unpleasant odors and is suitable for remote areas.
 - d. If lagoons are to be used, proximity to water sources need to be closely monitored.
 - e. Once the waste is reduced it can be pumped onto crop land.
 - f. Lagoons decrease the amount of nitrogen in the waste, which makes it less favorable for crop land.

(PowerPoint Slide #10) This slide shows a picture of an anaerobic lagoon. The animal waste is placed in this pond and bacteria break it down. The lagoon needs to be cleaned out to remove buildup of sludge. This sludge can then be used as fertilizer.

(PowerPoint Slide #11)

2. **Aerobic** lagoons are prepared and cared for in the same way except aerobic processes are done in the presence of oxygen.
 - a. Oxygen is introduced by pumping air into the lagoon.
 - b. This method reduces unpleasant odors.

(PowerPoint Slide #12) This is an example of an aerobic lagoon. It is exactly like an anaerobic lagoon except it has large pumps that help circulate oxygen throughout the lagoon.

(PowerPoint Slide #13)

3. Digesters
 - a. A **digester** is a large circular tank which is airtight and holds the fermenting slurry.
 - b. The digester is equipped with mixing and heating devices to keep the manure at 35°C.

- c. This is most commonly used to produce biogas that can be used to power generators or create heat for both domestic and farm applications.

(PowerPoint Slide #14) This slide shows a digester and a generator. In the top left is the digester tank. The gas produced from the bacteria fermentation is then pumped through pipes to the generator which is pictures in the lower right corner. The gas can also be used to heat homes or barns.

(PowerPoint Slide #15)

C. Composting

- 1. **Composting** is a method by which aerobic bacteria degrade organic matter to produce a humus-like material high in nutrients.

(PowerPoint Slide #16)

- 2. Under favorable conditions, manure can be composted in about ten days.
 - a. Favorable conditions include those which support the growth and reproduction of the bacteria, generally 60° C and moisture between 50 and 60%.
 - b. With this method, bedding wastes can also be mixed in.
 - c. The decomposition process is aided if the materials are placed in a large drum and rotated a few times a day.
 - d. Because of the high heat created in the composting process, the end product is sterile and is a very valuable fertilizer and soil conditioner that can be used to improve garden soils.

(PowerPoint Slide #17) This slide shows a picture of composted chicken manure.

(PowerPoint Slide #18)

D. Dehydration

- 1. **Dehydration** takes the longest amount of time to complete because it removes all or most of the water naturally present in the manure.
- 2. Poultry manure is very wet but contains higher amounts of dry matter content than any other manure.
- 3. Dehydration can be done in many ways.

(PowerPoint Slide #19)

- a. The manure can be dried directly in the housing unit if floors are used which allow for below ground waste storage.
 - i. Fans then circulate air and help the manure lose moisture.
- b. Another option is to mechanically dry the manure with a drier.
 - i. This can be costly as it requires some type of heating source to help remove the moisture.
- c. Manure can also be dried naturally by simply placing it outside in a thin layer.
 - i. There are many disadvantages to this such as high loss of nitrogen and nutrients, drying is slow and the end product will take longer to produce, weather can impact the drying process as an arid or semi-arid climate are needed.

(PowerPoint Slide #20) This slide shows pelleted dehydrated chicken manure. Pelleted manure helps release nutrients into the soil at a slower pace and is more beneficial to plants. This is how dehydrated chicken manure is commonly sold.

(PowerPoint Slide #21)

- E. Incineration
 - 1. **Incineration** is the burning of poultry manure.
 - 2. This method is very ineffective and wasteful.
 - a. Burning the manure releases nearly all of the beneficial nutrients into the atmosphere causing air pollution and bad odors.

Provide the students with a copy of or access to the document at <http://www.agr.gc.ca/volaille/manure.pdf>. Split the class into groups and have them make a chart of the advantages and disadvantages of each of the waste handling systems. Each group should then present and discuss their chart with the class.

Objective 3: Utilize poultry waste as fertilizer.

(PowerPoint Slide #22)

- III. Animal manures have been used as fertilizers for many centuries, but poultry manure has been recognized as the most beneficial.
 - A. Poultry manures are very high in nitrogen and can be effectively used as a soil amendment to increase organic matter.
 - B. Fertilizer is generally prepared first in some way, as discussed in Objective 2.

(PowerPoint Slide #23)

- C. Determining how much manure to use depends on the nitrogen content of the manure and the type of plant being fertilized and its nitrogen needs.
- D. Nutrient content of the manure will depend on the species of bird, what it is being fed and how it is managed and stored.
- E. Land that has been fertilized with poultry manure should not be used to raise other poultry for at least 4 years to reduce the chance of diseases spreading to other flocks.

Pass out copies of TM: C4-1, C4-2, and C4-3 for the students to observe. Ask the students, “Why is there a difference between the amounts of nitrogen and treatment methods?” and, “Why is there a difference between species and nitrogen content?”

Review/Summary: Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used to determine which objectives need to be reviewed or re-taught with a different approach. Questions on **PowerPoint Slide #24** can also be used.

Application: Place the students into groups. In their groups they should develop a poultry farm. They may choose to raise any combination of poultry or just one species of poultry. They may also choose to be any size, either large commercial or small family size. Once they have developed their poultry farm, have them determine a waste management plan for the farm. Will they have waste removal in the barns or will it need to be scraped out? What

method of waste management will work best for them? What will they do with the prepared manure? Have them present their ideas to the class. Provide them with paper so they can draw out their plan.

Evaluation: Evaluation should focus on student achievement of this lesson's objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. G
2. B
3. A
4. E
5. C
6. D
7. F

Short Answer

1. Incineration
2. Digester
3. Bacteria in animal wastes can contaminate drinking water and may cause potentially serious illnesses. High levels of nitrates in drinking water may particularly harm unborn or young infants and young livestock. Nutrients in animal wastes that enter streams also may lower oxygen levels and kill fish and other wildlife. Odors from animal operations may cause problems with neighbors and create a negative public perception of agriculture.

Sample Test

Name _____

Test

Unit C Lesson 4: Poultry Waste Management

Part One: Matching

Instructions. Write the letter of the correct answer next to the statement.

- | | | | |
|-------------|-----------------|---------------|----------------|
| A. Aerobic | B. Anaerobic | C. Composting | D. Dehydration |
| E. Digester | F. Incineration | G. Nitrates | |

- ____ 1. A form of nitrogen that develops naturally in animal wastes
- ____ 2. Bacteria consume manure in the absence of oxygen
- ____ 3. Processes are done in the presence of oxygen.
- ____ 4. A large circular tank which is airtight and holds the fermenting slurry.
- ____ 5. A method by which aerobic bacteria degrade organic matter to produce a humus-like material high in nutrients.
- ____ 6. Removes all or most of the water naturally present in the manure.
- ____ 7. The burning of poultry manure.

Part Two: Short Answer

Instructions. Provide a short statement to answer the question.

1. Which method of poultry waste handling is most expensive and inefficient?
2. Which method of poultry waste handling creates gasses which can be used to power and heat farms and homes?
3. What are some dangers of improperly handled animal waste?

TM: C4-1

Average Nutrient Composition of Chicken Manures

Manure Type	Total N	Ammonium (NH₄-N)	Phosphorus (P₂O₅)	Potassium (K₂O)
<u>Broiler</u>	kg/tonne			
Fresh (no litter)	13	5	8.5	5.5
Broiler house litter	36	5.5	39	23
Breeder house litter	15.5	3.5	27	15.5
Stockpiled litter	18	4	40	17
<u>Layer</u>				
Fresh (no litter)	13	3	11	5.5
Undercage scraped	14	7	15.5	10
Highrise stored	19	9	28	15
	kg/3785 Liters			
liquid slurry	7.36	4.99	7.01	4.39
Anaerobic lagoon sludge	3.09	0.95	10.92	1.54

Source: <http://edis.ifas.ufl.edu/aa205>

TM: C4-2

Average Nutrient Composition of Turkey Manures

In Kg/Tonne

Manure Type	N	NH ₄ -N	P ₂ O ₅	K ₂ O
Fresh (no litter)	13.5	4	12.5	6
Brooder house litter	22.5	4.5	26	16
Grower house litter	28.5	8	36	20
Stockpiled litter	18	4	36	16.5

TM: C4-3

Average Nutrient Composition of Duck Manures

In Kg/Tonne

Manure Type	N	NH ₄ -N	P ₂ O ₅	K ₂ O
Fresh (no litter)	14	2.5	11.5	8.5
House litter	9.5	1.5	8.5	7
Stockpiled litter	12	2.5	21	11