Composting for **Routine Disposal of Poultry and Livestock Mortalities**
Learning Objectives

- Why Compost? .... pros & cons
- Equipment, facilities, space and planning, cover materials
- Bin composting procedures
Why Compost?
Pros & Cons

- Why some producers say they compost
  - Timeliness - allows producers to manage mortalities promptly ... no waiting for ground to thaw out for burial, or for rendering truck to arrive
  - Works for all sizes and species of animals
  - Perceived biosecurity concerns associated with rendering truck moving from farm to farm
  - Loss, or fear of losing, rendering service
Why Compost?
Pros & Cons

- Why some producers say they do NOT compost
  - Takes more time than rendering
  - Requires management and technical understanding of composting
  - Requires large amount of material to cover carcasses during processing
    - Ground cornstalks, ground straw, sawdust/woodchips, silage, poultry litter
  - Requires time and land area to dispose of finished compost
Mortality composting uses typical farm equipment

- Tractor/loader or skid loader
  - Haul carcasses and cover materials
  - Build, turn, and unload compost bins, or deconstruct windrows
- Manure spreader to haul and land apply finished compost

Specialized equipment that is recommended

- Long-stem dial-type composting thermometer to check internal compost temperatures ..... useful for troubleshooting
  - Recommend 36- or 48-inch stem length
  - Approximate cost $100-$150
Developed by Dr. Tom Glanville and Dr. Jay Harmon, Department of Agricultural & Biosystems Engineering, Iowa State University, for ISU outreach program on Poultry & Livestock Disposal in Iowa, sponsored by Iowa Department of Natural Resources.

Facilities

- **Roofed bins**
  - Recommended for small to mid-size species
    - Chickens, turkeys, sheep, swine
  - Roof minimizes problems caused by wet weather
    - Leachate release
    - Odor
    - Low temperature
    - Slow carcass decomposition
Facilities

- **Unroofed bins or windrows**
  - Recommended for emergency disposal
  - Or for large species (cattle) that would require uneconomically large roofed bins

- For more info on using unsheltered windrows see companion presentation in this series .... “Composting for emergency disposal of poultry and livestock mortalities”
Facility Example
Back-to-back bins, concrete walls, with cover material storage

This facility sized for average daily losses of 300 sow farrow-finish operation.
Facility Example
Single-row configuration, treated lumber walls

This facility sized for average daily losses of a 450 sow farrow-to-nursery operation
Facility Example
Low-cost bins, constructed in unused shed

Bins constructed with used materials (slat panels) inside unused shed.

Composting need NOT be complicated or expensive!
Required Bin Space
For chickens, turkeys, similarly sized carcasses

- Estimate annual pounds of mortalities based on operating records
- Divide annual pounds by 365 to get average daily pounds of loss
- Multiply average daily loss by 2 to get total cubic feet of bin volume needed
**Required Bin Space**

For swine, sheep, & similarly sized carcasses

- Estimate total annual pounds of mortalities based on operating records

- Divide annual pounds by 365 to get average daily pounds of loss

- Multiply average daily loss by 40 to get total cubic feet of bin volume needed
Bin Dimension Guidelines

- **Minimum** bin width (feet) = 2X loader bucket width in feet

- Bin length (feet) = 1 to 2X bin width

- **Maximum** recommended loaded bin height 5 feet (make bin wall height 1 foot higher)

- **Individual** bin volume in cu. ft. = width (ft) X length (ft) X loaded bin height (5 ft)
Number of Bins Required

- Divide **total** bin volume by individual bin volume
- Round the result UP to nearest whole number
- IF result is an odd number of bins, add 1 more to get an even number
Additional Storage Considerations

- For envelope materials (placed over and beneath carcasses)
  - Must be sheltered to keep them dry
  - Can incorporate envelope material storage bins into composting system (as shown in slide #8), or store materials in nearby shed

- For processed compost
  - Stockpile area where materials removed from bins can “cure” or “mature”
  - Need not be sheltered ... but all soft tissues of all carcasses must be fully decomposed before removing compost from bins and placing in curing pile
Additional Space/Planning Considerations

- Location of composting bins
  - Convenient to production facilities
  - On a well-drained area
    - No runoff onto or off of composting area
    - Recommend construction of an all-weather surface that permits accessibility during inclement weather
      - compacted soil or granular aggregates, asphalt, or concrete
  - Minimum required separation from environmentally sensitive areas
    - 500 ft from residences
    - 200 ft from public wells, 100 ft from private wells
    - Outside of wetlands, 100 ft from surface water bodies
Additional Space/Planning Considerations

- Compost Application Area
  - Iowa rules allow mortality compost to be applied to cropland or pastureland without a permit ... application to other types of land requires IDNR approval
  - Mortality compost nutrient value can be highly variable
    - Greatly affected by type and amount of envelope materials used
    - Test before applying, & follow accepted nutrient management practices
Envelope Materials
Placed under, over, & around carcasses

- Envelope material performs MANY important functions
  - Retains heat
  - Absorbs excess moisture
  - Provides carbon – essential for bacteria that decompose carcasses
  - Retains pathogens and odor
  - Discourages insects & scavengers
Cover Material Selection

- **The BEST**
  - Sawdust, wood shavings
  - Poultry litter
    - With small or moderate manure content

- **Will work– but requires some extra processing**
  - Cornstalks or straw
    - Must be ground to reduce fiber length
      - Un-ground materials too coarse .... can lead to heat loss and odor release
      - Grinding also improves liquid absorption capacity
  - Hoop building bedding
    - Avoid bedding that is soggy or contains large amounts of manure
Cover Material Selection

- Selecting good cover materials
  - Should have coarse-texture
    - 1/8th inch minimum dimension, 1-2 inches maximum dimension
    - Obvious pore spaces between particles (below right)
- Avoid “soil-like” materials
  - Those comprised of very small particles with tiny pore spaces hinder entry of vital oxygen (below left)

![Poor texture – too tight](poor-texture.jpg)  ![Better texture – obvious pore structure](better-texture.jpg)
Use of whole (un-ground) cornstalks in this cattle mortality composting windrow led to formation of large gaps (center of photo), significant heat loss, and serious odor emissions.

As shown above, application of ground straw over the whole stalks failed to control flies attracted by odor emissions.

(Photocourtesy of Dan Olson, Iowa DNR)
Envelope Material Quantities

- Quantities vary with type of material, size of carcass, loading practices of operator

- 7-8 cubic yards of envelope material per 1,000 lbs of carcasses is reasonable rule of thumb for \textit{bin} composting
Composting Procedures

- **Use PLENTY of envelope material** around carcasses to retain heat, odor, & leachate
  - To prevent odorous leachate release, use 12-inch base layer and separation from bin walls
  - Space small carcasses 2-4 inches apart, large 6-12 inches, to avoid excessive wetness

- Use 4-6 inches of material **between layers** of small carcasses, 6-12 inches between layers of large carcasses
- **Cap** with 6-12 inches to minimize insect and rodent attraction

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Composting Procedures

- Moving introduces oxygen, redistributes moisture, speeds decomposition
- 450 lb sow midway through decomposition

- Move compost from one bin to another midway through decomposition
- Approximate decomposition times
  - 2-4 weeks for poultry
  - 1-2 months – pigs < 100 lbs
  - 2-3 months - pigs > 100 lbs

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Composting Procedures
Temperature Monitoring

- Low temperatures (< 100 °F)
  - Cover material too wet, too thin, or too porous to retain heat
  - Insufficient pile size to retain heat
- High temperatures (> 160 °F)
  - Can kill beneficial composting organisms
  - Turn pile to cool the mix

For additional info on dealing with mortality composting problems - see companion presentation “Troubleshooting On-Farm Mortality Composting”
Composting Procedures

- Iowa rules allow mortality compost to be applied to cropland or pastureland without a permit ... application to other types of land requires IDNR approval

- Finished compost WILL contain some bones
  - Dry, free from soft tissues
  - But may attract scavengers
  - Not recommended to spread near residences
Routine Mortality Composting
Do’s & Don’ts

- **DO**
  - Keep carcasses well covered & away from edges of bin ... to prevent leachate release.
  - Turn compost, at least once, about halfway through the decomposition process ... to introduce fresh oxygen and redistribute moisture.
  - Check compost temperatures to spot cool areas that signal excessive wetness, inadequate cover depth, cover material that is too coarse to retain heat.
Routine Mortality Composting
Do’s & Don’ts

- **DON’T**
  - Overload the composting process
    - Every 1000 lbs of carcasses contains 600 lbs of water
    - Too many carcasses with too little envelope material leads to saturation, odor, & slow decomposition
  - Allow compost to become saturated due to exposure to excessive precipitation
  - Use envelope materials that are too coarse
    - Can lead to excessive heat loss and odor release
Review

- Some benefits of composting?
- Some drawbacks of composting?
Review

● Some benefits of composting?
  ○ Timeliness, puts producers in total control of disposal
  ○ Works in all seasons
  ○ Can be used for all sizes of carcasses

● Some drawbacks of composting?
  ○ Takes more time than rendering
  ○ Requires management and technical understanding
  ○ Requires large amount of cover material
  ○ Requires land area to dispose of finished compost
Review

- A important item of “specialized” equipment used in mortality composting that is not normally used in livestock production?
Review

- An important item of “specialized” equipment used in mortality composting that is not normally used in livestock production?
  - Composting thermometer
Review

- What information is needed to estimate total amount of composting bin space needed for an operation?
Review

What information is needed to estimate total amount of composting bin space needed for an operation?

- **DAILY average weight of losses**
  - Multiply daily average losses by 2 to get total cubic feet of space for poultry or similarly sized carcasses
  - Multiply daily average losses by 40 to get total cubic feet of space needed for swine or similarly sized carcasses
Review

- What is the total bin volume needed for a swine operation with 30,000 lbs of loss per year?
Total bin volume needed for swine operation with 30,000 lbs of loss per year?

- Daily Average Loss = 30,000 lbs/365 days = 82 lbs/day
- Total bin volume = 82 X 40 = 3280 cu ft
Review

- Using guidelines shown below..... what would be appropriate bin dimensions for skid loader with 4 ft wide bucket?
  - Minimum bin width = 2X bucket width
  - Bin length = 1 – 2 X bin width
  - Working depth = 5 ft
- For “extra credit” .... what would be the working volume of the bin?
Review

- **Recommended bin dimensions**
  - Minimum width = 2X bucket width
    - 2 X 4 ft = 8 ft
  - Bin length 1 to 2X bin width
    - 1.5 X 8 ft = 12 feet
  - Working depth = 5 ft (6 ft bin walls)

- **Working bin volume**
  - = width X length X working depth
  - = 12 X 8 X 5 = 480 cu ft
Review

- If total bin volume is 3200 cu ft, and individual working bin volume is 480 cu ft, how many bins are needed for this operation?
If total bin volume is 3200 cu ft and individual working bin volume is 480 cu ft, how many bins are needed for this operation?

- \# bins = total bin volume / individual bin volume = 3200 / 480 = 6.8 bins
- Round UP to nearest whole bin = 7 bins
- Add 1 if necessary to get even \# of bins = 7 + 1 = 8 bins
Development of this educational presentation has been funded in part by the Iowa Agricultural Experiment Station, Iowa State University Extension, and by the Iowa Department of Natural Resources through a grant from the U.S. Environmental Protection Agency under the Federal Non-point Source Management Program (Section 319 of the Clean Water Act).

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June, 2006