

Livestock Mortality Composting

FOR LARGE AND SMALL OPERATIONS IN THE SEMI-ARID WEST

REGIONAL WEBCAST

June 20, 2012 – 12:00PM MTN

(For CCA-CEU, sign-in by entering name and CCA# in Chat Pod – live webcast only, not archive)

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Project Products

- Manual (English and Spanish)
- Video
- Budget & Decision Tool
- PowerPoint Companion

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Mortality Management

- The purpose of proper mortality disposal is to prevent the spread of infectious, contagious and communicable diseases and to protect air, water and soil quality.
- Most states have laws through environmental or agricultural authorities to regulate proper animal mortality disposal.

Illegal or Discouraged Option

- **Carcass Abandonment**: likely illegal in most states in the U.S.
  - Promotes:
    - extreme biological and disease hazard,
    - threats to water quality,
    - odors, flies, scavengers, rodents,
    - and visual pollution

Credit: Rilho – fotocommunity.com

Generally Accepted Options

- **Incineration:** done in a properly engineered device with emission controls
  - consumes entire animal
  - high fuel consumption
- **Burning:** primarily an emergency measure
  - difficult to maintain flame and temperature
  - difficult to consume animal
  - uncontrolled emissions

Generally Accepted Options

- **Burial**: most commonly accepted method
  - defined separation distances from ground and surface water
  - defined amount of coverage over animals
  - Site may require soils assessment and permitting

Generally Accepted Options

- **Landfilling**: “buried” at licensed landfill
  - must be accepted by individual facility
  - requires transportation and tipping fees
- **Rendering:** heat driven process to separate products from tissues
  - requires transportation and possible storage of carcass
  - diminishing opportunities across U.S.

Generally Accepted Options

- **Composting**: is gaining more acceptance as a legal option in most states
  - natural process driven by oxygen, moisture and microbes
  - feasible for larger carcasses, even in cold semi-arid climates
  - reduced environmental risks
  - and the generation of a useful end-product*

*limited use recommendations are covered later in this presentation.

Compost is a, "managed, biological, oxidation process that converts heterogeneous organic matter into a more homogeneous, fine-particle humus-like material" (Field Guide to On-farm Composting, 1999)

Composting Principles

- "Farming microorganisms" – primarily bacteria and fungi; to compost, they require:
  - Carbon: fibrous waste such as wood chips, straw and crop residues
  - Nitrogen: component of manure, carcasses, and plant material
  - Oxygen: passive aeration and by turning
  - Water: ideal content is approximately 50%

Composting Principles

- Carbon and nitrogen are usually supplied in a 30:1 ratio for best results
  - commonly expressed as C:N = 30:1
- For livestock mortalities, especially large carcasses, the 30:1 wisdom does not apply
  - recommended carbon for dead animals far exceeds this, due to construction of piles or windrows with proper cover

Composting Principles

- Oxygen is maintained in aerobic composting by turning, and initial particle size.
  - turning mechanically aerates as the pile is mixed
  - mortality compost is turned on a limited basis
  - larger or coarser carbon material allows more passive aeration; ie: airflow
  - a coarse carbon base is recommended for mortality composting

Incorporating Animals into the Composting Process

- Carcasses should be laid on their side
- Base should be 18 to 24 inches of coarse carbon
  - larger wood chips
- Margins of coverage should be 18- 24 inches as well

Incorporating Animals into the Composting Process

- Smaller carcasses can be arranged, as before…
- Base should be 18 to 24 inches of coarse carbon
  - larger wood chips
- Margins of coverage should be 18- 24 inches as well

Incorporating Animals into the Composting Process

Base and Cover

- Coarse base material aids in passive aeration for first 3-6 months
- Material around carcass may be finer
  - active compost, manure solids or spoiled silage help get microbial activity started
- Cap should be non-odorous, and will act as insulation and bio-filter
  - add extra cap/cover as needed

Tips!

- Ideal moisture of core materials (closest to carcass) is (50-60%)
- Warm materials help start process in winter
- Carcasses not yet frozen from winter temps will heat faster
- Even with freezing ambient temperatures, composting will happen

Tips!

- Even with freezing ambient temperatures, composting will happen!
  - core temps were 140F+, when this photo was taken at Havre, Montana

Carbon Options

- See carbon source table in manual for full list of examples:
  - course wood chips
  - sawdust
  - straw
  - silage
  - manure solids
  - corn stalks
  - crop processing wastes

Carbon Options

- Reminder:
  - materials with moisture of 50-60% will help maintain process for weeks without irrigation or turning
  - adequate base and cover will prevent leaching of carcass moisture and odors
  - low odor reduces neighbor complaints and scavenger problems

Windrows, Bins & Sizing

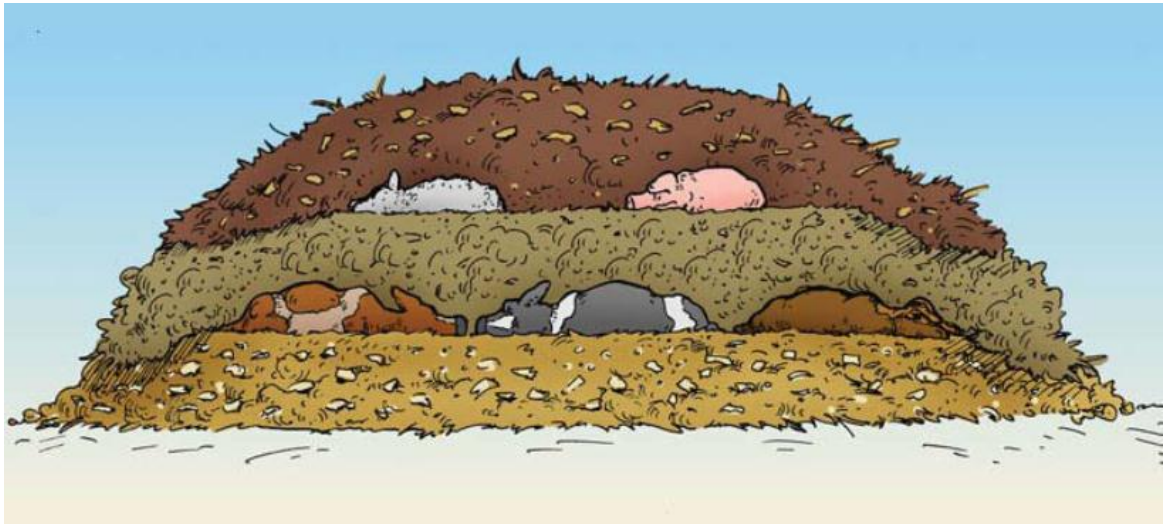
- Windrows have the largest footprint and will require the most carbon material for base and cover
  - windrows may be ideal for multiple mortalities over a shorter period of time
- Bins will reduce footprint and conserve carbon material supply
  - bins may be ideal for layered small carcasses or intermittent larger mortalities

Windrows, Bins & Sizing

- Estimates of total material for full grown cow in a single pile range, from 12 cubic yards down to 7.4 cubic yards
  - to make a windrow, add new carcasses up against first pile, and cover appropriately
- Practically speaking, for a mature cow, proper base will be about 9 feet wide by 10 feet long
  - core and cap materials should be a margin of 18-24 inches

Windrows, Bins & Sizing

- Margins between layers of small carcasses can be 8-12 inches
  - final cover margin should still be 18-24 inches



Tips on Bins

- Bins may be constructed of:
  - hay bales
  - concrete barriers
  - wooden structures
- Bins are easier to fence/block to exclude scavengers
- Passive aeration may be reduced with bins, and slightly lengthen process

Facilities Construction and Engineering

- Additional information and USDA-NRCS standards for this practice and *related facilities/structures* can be found in Practice Standard 316 and the National Engineering Handbook

NRCS Natural Resources Conservation Service

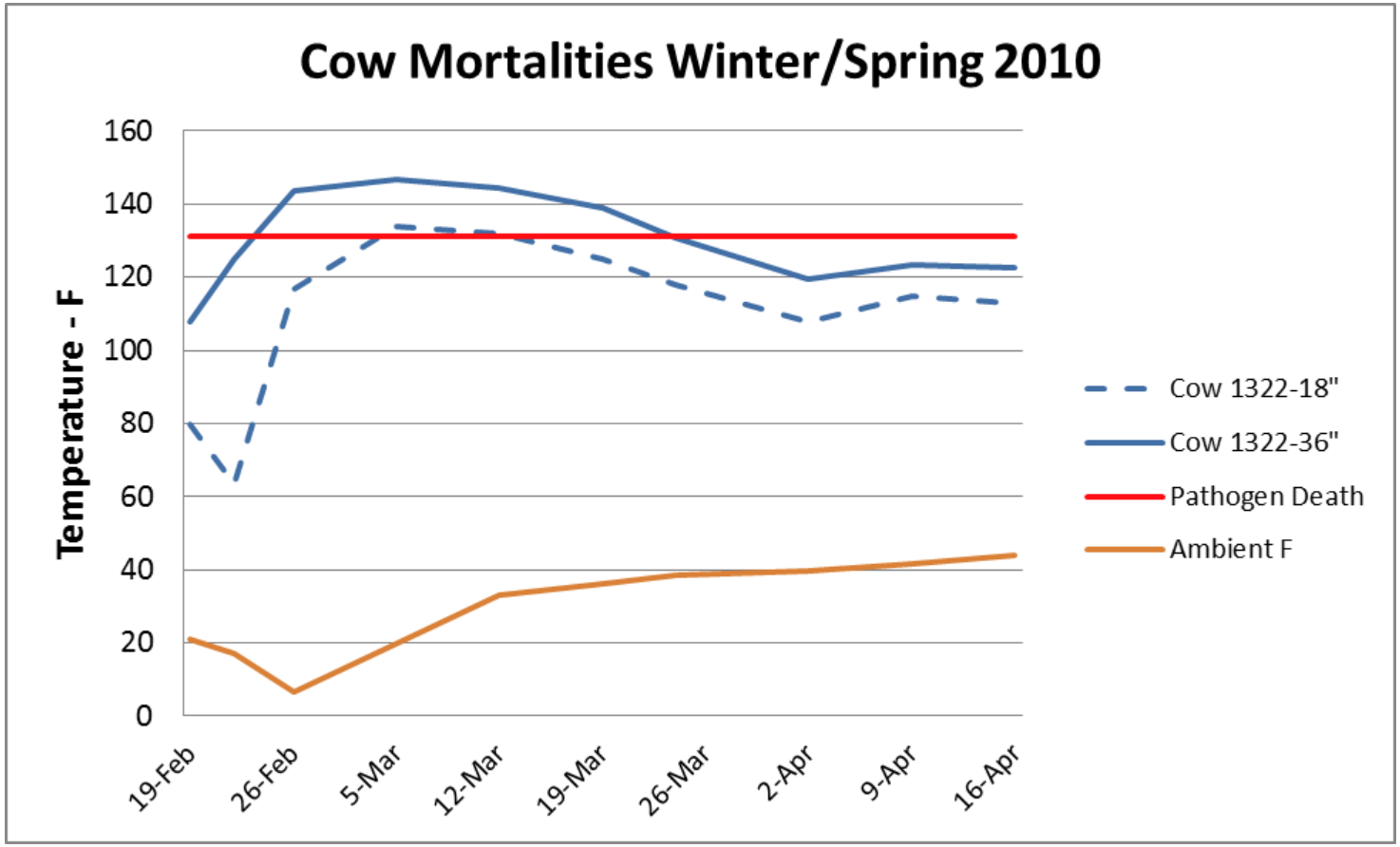
Monitoring and Management

- Composting takes 4-12 months depending on mortality size and mixture
- The process is passive and should not be turned for 4-6 months
  - the pile, windrow or bin can be turned after this point
- Most soft tissue will be gone within 6-8 weeks!

Monitoring and Management

- Temperature:
  - optimum composting happens with core temperatures between 120 F – 150 F
  - below 80 F, microorganisms are not thriving
  - could be too dry or have low oxygen
  - temperature can be checked with a probe thermometer

Monitoring and Management



Monitoring and Management

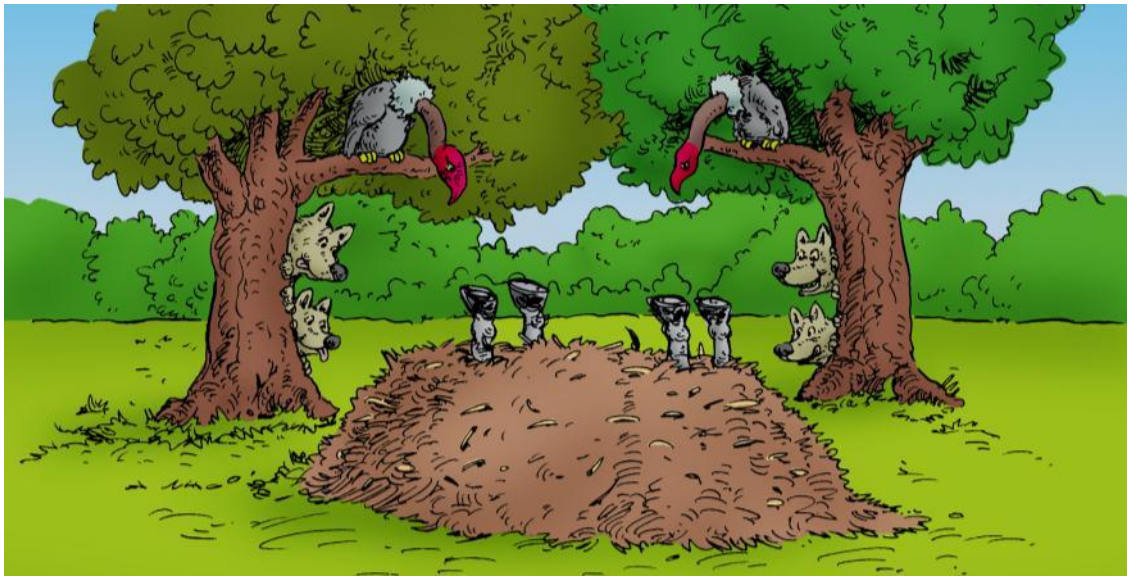
- Moisture:
  - since this process is largely passive, starting with proper moisture is important
  - carbon sources with 50% – 60% are ideal
  - it may be necessary to wet core and cap if materials are extremely dry (when carcass is added)
  - after the passive phase, water can be added with turning

Monitoring and Management

- Other Issues:
  - monitor for scavenger activity
  - monitor for excessive flies
  - make sure cover is adequate over time
- The compost area should be free of these problems if basic directions are followed
  - i.e.: good carbon materials, proper starting moisture, and proper cover

Monitoring and Management

- Maintaining cover should prevent scavengers
  - at research sites, known dogs, coyotes and birds did NOT disturb properly covered piles



Curing and Storage

- After trial and error to determine site specific time for passive phase, turning will help finish
- Some large, but brittle bones may remain
- Materials may have dried out
- Breakdown of carbon material and particle size reduction may inhibit passive aeration

Curing and Storage

- After 4-6 months…
  - turn
  - irrigate if necessary
  - remove large bones if desired
  - let “cure” for another 4-8 months

Curing and Storage

- Curing: period of warm, but not hot, composting
  - final breakdown will occur
  - temperature will cool to near ambient conditions
  - may use compost for new mortalities or limited land-application

Site Selection

- An appropriate site will:
  - help to protect water and soil quality
  - protect bio-security (prevent spread of pathogens or disease)
  - prevent complaints and negative reactions of neighbors
  - decrease nuisance problems
  - minimize the challenges in operating and managing the composting operation.

Site Selection

- Location of the composting site should be:
  - above/out of floodplains
  - easily accessible (in most weather)
  - require minimal travel
  - be convenient for material handling
  - maintain an adequate distance from live production animals to reduce the risk of the spread of disease.

Site Selection

- The compost site should also be:
  - in a well drained area
  - on soils of low permeability or a pad
  - graded to prevent “pooling” or “ponding”
  - protected from run-on from land above site
- Check local regulations for depth above groundwater and separation from surface water and wells!

Site Selection

- Storm water
  - divert storm water from land area above site with berms or ditches
  - direct rain and snow may be beneficial in semi-arid west
  - if excessive storm water is possible, a run-off collection system may be necessary
  - grass filter strips may also be appropriate

Equipment Decisions

- Most mortality composting can be done with basic equipment already on-site
  - front end loader or skid steer loader
  - probe thermometer
  - water source and hose
  - screen (optional)

Equipment Decisions

- Hand-made screen to separate bones and unfinished coarse materials
  - these may be added back to another hot pile

Effect of Climate

- This process will work in the cold semi-arid west!
- Review:
  - proper moisture
  - active core material helps maintain temperatures
  - place non-frozen carcasses when possible
  - proper cover to maintain temperatures and internal moisture

Issues to Watch Out For

- Bones – screening or removal is recommended
- Operational mortality – consider number of predicted mortality and size site accordingly
- Scavengers and odors – largely controlled by proper cover and choice of cap materials

Issues to Watch Out For

- Nuisance insects – high moisture can lead to breeding of flies
- Neighbor/public relations – consider visual screens or site away from road or neighbor view
- Maintain recommended practices and management to mitigate all potential issues

Compost Quality and Use

- Finished mortality compost can have limited use on-site
  - use for future mortality composting
  - use on non-food crops as soil amendment or fertilizer
  - do NOT export from operation or sell
  - consult veterinarian if mortalities are disease related

Diseases and Prions

- Consult with veterinarian before composting is started regarding all disease issues
- Prion diseases may not be killed by composting
  - BSE may be unlikely due to USDA/FDA controls
  - however, scrapie (in sheep and goats) in small ruminants is known to exist in North America
  - chronic wasting disease is known in deer and elk

Emergency Situations

- All livestock operations should have an emergency plan
- Work with Extension or NRCS to develop a plan to deal with flood or high winds damaging the compost site
- Refer back to site selection recommendations

Emergency Situations

- Composting can be a valuable tool for emergency management
- Catastrophic mortality events can be managed with composting
- Consult veterinarians and emergency managers before initiating emergency mortality compost measures!

Economics

- Mortality composting may be the most economic practice
  - less labor than digging pits
  - same site can be reused
  - no transportation, tipping fees or rendering fees
  - basic equipment is likely already on-site

Economics

- See “partial budgeting” tool and worksheet
- Will a change in practices be beneficial to the economics of the business?
  - Additional Returns: not likely as mortality compost is not recommended for sale
  - Reduced Costs: likely as composting can be the least cost practice

Economics

- Will a change in practices be beneficial to the economics of the business?
  - Additional Costs: possible, if carbon materials or equipment purchases are required
  - Reduced Returns: possible if carcasses were sold to a renderer

Econ - Sample Partial Budget

Partial Budget Form

Proposed Change: Composting Livestock Mortalities Vs. Rendering Service (10 Cows Annually)

Additional Returns		Additional Costs	
Compost/Fertilizer		Equipment Repairs	150.00
		Carbon Source	200.00
		Equipment Labor	500.00
Total Additional Returns	$ -	Total Additional Costs	$ 850.00
Reduced Costs		Reduced Returns	
Rendering Charges	1,250.00		
10 @ $125			
Total Reduced Costs	$ 1,250.00	Total Reduced Returns	$ -
A. Total Additional Returns & Reduced Costs	$ 1,250.00	**B. Total Additional Costs & Reduced Returns**	$ 850.00
		Net Income Change (A Minus B)	$ 400.00

Econ – Simple Scenario #1

- Additional returns: $0 (compost will NOT be sold)
- Reduced Costs: burying a carcass costs $200 (hired labor and rented back-hoe)
- Additional costs: $50 (operation has silage, straw and front end loader already, but must pay existing labor to do job)
- Reduced returns: $0, no sale of carcasses to renderer
  - operation comes out $150 ahead for composting

Econ – Simple Scenario #2

- Additional returns: $0 (compost will NOT be sold)
- Reduced Costs: $0 (carcasses picked up by renderer)
- Additional costs: $50 (operation has silage, straw and front end loader already, but must pay existing labor to do job)
- Reduced returns: $40 (renderer would have paid for fresh carcass)
  - operation **loses $90** (cost of labor & loss of sale)

Economics – Complications

- Does composting provide other benefit?
  - use on own crop land?
  - better biosecurity?
- Is composting less labor than burial with existing equipment?
- Will any compost equipment choices pay-off over time? How long?

Economics – Decisions

- Work with producer to analyze all benefits/costs
- Advise but let producer weigh options and make decision

Regulations and Permitting

- Composting is likely regulated!
- Could be:
  - stand-alone regulations
  - already covered by AFO/CAFO permit
- May be supervised by:
  - Department of Ag
  - Department of Livestock
  - Environmental or Waste Department

Regulations and Permitting

- Consult with:
  - state agencies
  - advisors and technical service providers
    - Extension
    - NRCS
    - commodity association
    - consultant
- Manual has basic information and contacts for MT, WY, CO and NM!

Summary

- Composting is a feasible practice for mortality management in the cold semi-arid west
- It is also proven in more moderate climates
- Composting may be preferable for:
  - economic reasons
  - biosecurity
  - public and neighbor relations

Summary

- A Quick Reference Guide is provided at the end of manual
  - Step-by-step, 2-page summary
  - Download to view

Quick Reference Guide

Critical components of livestock mortality composting. Refer to text for more complete explanations.

Step	Considerations
Planning	**Does it make sense for your operation?** Composting is a good alternative for any operation that has appropriate space and equipment for moving mortalities and compost materials. **Permitting:** Check with county and state agriculture and environmental offices (see section "State Regulations and Permitting" for more information). **Minimum tools:** tractor with frontend loader; 36- to 48-inch compost thermometer.
Select a site	**Size:** About 200 cubic feet per 1000 lbs. of livestock mortality, or 10 x 10 x 6 feet for a single large animal pile, or 6 x 6 x 6 feet for a bin. **Shape:** Windrows are best for airflow and ease of management, but bins made from wood or large hay bales allow tighter piling and a smaller footprint. **Location:** Choose an area with enough space to build and turn compost, deliver and move mortalities and base, core, and cover materials. It should be away and downwind from neighboring properties where scavenger activity can be monitored and discouraged. **Drainage:** Choose fine (not sandy or gravelly) well drained soils at least 3 feet above ground water and 300 feet from streams, ponds, wells, other water resources. An ideal site would have a gentle slope for drainage. Underlay piles on coarse soils with 6 inches of compacted sand or gravel, or sometimes clay or concrete. Construct berms to divert runoff if necessary. **Covering:** Compost piles in the semiarid west generally do not need to be covered, but should be monitored for runoff or seepage during unusually wet periods events.
Build the compost pile	**Lay the base:** 12 to 24 inches of wood chips or shreds that allow air flow and are not compactable or excessively wet. Spread to allow 18- to 24-inch margin. **Prepare the animals:** Breaking up large mortalities will speed the process. The body cavity should be opened and the rumen punctured for cattle, sheep, and goats to prevent excessive bloating and displacement of cover material. **Place the animals:** Place large mortalities on one side in the center of the base material. Smaller mortalities can be stacked with 8 to 12 inches of core material between layers. **Place the core:** 12 to 18 inches of fine, actively composting material with 50 to 60 % moisture content, such as manure, silage, or recycled compost is ideal *(squeeze test: at 50-60% moisture a few drops can be squeezed from a handful of material)*. Adding water is often necessary to start at this moisture level. **Place the cap:** 6 to 12 inches of fine, moist, low-odor material such as sawdust with 50 to 60 % moisture content to achieve 18- to 24-inch final margin around mortalities. Form flat or troughed top to collect moisture in dry regions. Peak the top to shed moisture in wetter areas.

Summary

- Visit: http://livestockandenvironment.org to download or order project products and tools;
  - Click on *Projects*, then *Summaries*; select *Mortality Management*

- Questions and Comments?

Thank you for your time!

Project Products

- Manual (English and Spanish)
- Video
- Budget & Decision Tool
- PowerPoint Companion

http://livestockandenvironment.org