

# An Economic Evaluation of Dead-Bird Disposal Systems

A continuous challenge unique to poultry producers is the on-farm disposal of dead birds. In 1993, Alabama ranked second in the nation in broiler production. While the industry produces 18 million broilers every week, it generates 800 tons of carcasses weekly, as well. Every producer, whether large or small, must choose a disposal method that is economical as well as biologically and environmentally sound.

This circular discusses the methods that are currently being used in the industry—disposal pits, large-bin composting, and incineration—and the emerging technologies—small-bin composting, fermentation, and refrigeration. It also presents a comparison of costs and other criteria which can help a grower evaluate the various dead-bird disposal systems.

## Existing Disposal Methods

### *Disposal Pit*

Although it is impractical for a modern day poultry grower to dig a hole every day for burying carcasses, burial is an appropriate means of disposal. Properly constructed poultry disposal pits are a convenient, sanitary, and practical method for handling poultry mortalities.

A disposal pit is, in its simplest form, a shored-up hole dug in the ground with a small diameter opening at the top through which carcasses are dropped. In

the past, this type structure was adequate for small producers with a limited amount of daily mortalities. Today, with larger birds and flock sizes, poultry producers are using concrete- or timber-lined pits to assure proper performance and useful life of the structure. The pit provides an environment for both aerobic and anaerobic microorganisms to decompose organic materials. A tight-fitting lid will reduce odors and restrict access by children, rodents, and insects. Those insects that survive in the pit without becoming a nuisance actually help to accelerate carcass decomposition.

Successful use of a disposal pit requires proper on-site location, appropriate design, and quality construction. Location of the pit is critical to avoid contamination of water sources. Disposal pits should be used only at locations where ground water level is well below the pit bottom and where soil type permits good infiltration of effluent from the pit area. The pit itself produces little water, but water seeping into pits can cause problems. Construction should not be on a slope or in an area where water could stand or seep into the pit site.

The cost of disposal pits will vary widely depending on materials used (treated lumber, pre-cast concrete, etc.) and size of pit. Larger pits require heavier construction for walls and tops, adding to initial cost. A useful pit life of 5 years is typical.

### *Large-Bin Composting*

Testing and adoption of composting as a method for the disposal of poultry carcasses began in Alabama in the late 1980s. Poultry producers have readily accepted the composting of poultry carcasses. Since 1989, Alabama poultry farmers have constructed more than 800 free-standing composters.

Using composting methods for disposal has several advantages. It eliminates disease spread and air or water pollution. Tests on certain pathogens show that they do not survive the increased temperatures that contribute to the composting process. In field operations, odor and insects have not been a problem. Perhaps the best reason for composting is the valuable end by-product created by this process. Composted carcasses can easily be stockpiled until needed for land application as fertilizer for field and forage crops.

Composting is a controlled, natural process in which beneficial microorganisms—bacteria and fungi—reduce and transform or change organic wastes into a useful end product—compost. In dead-bird composting operations, a prescribed mixture of dead chickens and caked litter provides the necessary ingredients for changing the mixture to compost.

Composters can vary considerably and still perform well. However, certain elements are necessary to insure proper decomposition and to promote safe

operation. The composter must have a roof which ensures year-round operation and controls rainwater and percolation of runoff water. Another necessity for all-weather operation is a concrete foundation. A weight-bearing concrete floor secures the composter against rodents or dogs and prevents contamination of the surrounding area. Building components that contact the compost must be constructed from pressure-treated lumber or rot-resistant materials that will resist the biological activity of composting.

Composter size is based on broiler production capacity, dead-bird size, and percent mortality. The large-bin composting method requires a two-stage process. Capacity of the first stage composter bins in cubic feet equals 0.0025 times final bird weight times farm capacity per cycle. A second stage bin of the same capacity is necessary.

On farms with a large flock, a tractor-loader is used to move carcasses and composting materials. The tractor-loader will also be used to move finished compost to a storage shed or pile and then to the field for land application. Loading and managing a composter sized for a broiler farm having a 100,000 bird capacity takes about 20 minutes a day, not counting the time it takes to pick up dead chickens.

The total cost of composting will depend on both the composter size, which is based on flock capacity, and the cost of labor to operate the unit.

### *Incineration*

Incineration is often the chosen method of disposal in poorly drained areas where pits are not acceptable or where rocky soil makes digging expensive. Recognized as one of the most biologically safe methods of disposal, incineration curtails the

spread of disease and does not create water pollution problems. The comparatively small amount of waste by-product (ash) does not attract insects or scavengers and can be disposed of easily. The main environmental concern is the emission of particulates generated during the burning process. In addition to particulate emission, other concerns are fuel costs, required maintenance, and unit replacement.

The Alabama Department of Environmental Management requires the use of Class 4 incinerators for disposing of poultry mortalities. These units are available with oil or gas burners. When selecting an incinerator, the grower should look for a sturdy unit that can withstand heavy loading and high temperatures. A concrete slab and a shelter to house the incinerator will prolong the life of the unit.

The poultry grower should carefully calculate the cost of operation before purchasing an incinerator. In estimating operating costs, the grower must consider the burn rate and fuel costs. Providing a concrete slab and a shelter to house the incinerator will add to the initial costs but will also prolong the life of the unit.

## Emerging Technologies

### *Small-Bin Composting*

Because large broiler farms use tractor-loaders in their farming operations, they have readily adopted poultry composting. On the other hand, small broiler farms, with only one or two grow-out houses, may not have a tractor-loader and may have hesitated in adopting composting. Small-bin composting—also called mini-composting—can be accomplished without major construction, machinery, or equipment.

The simplest design for a mini-composter consists of a wooden bin that will hold the dead poultry and other composting ingredients. The portable composting bin is 4 × 4 × 4 feet with removable side panels. The bin is constructed from pressure-treated lumber with ½-inch air spaces between side boards. An average 20,000-bird house requires four to five compost bins to handle normal bird mortality during a typical grow-out period. In Alabama, compost bins are placed under a small roofed structure separated from the poultry house.

The cost of mini-composting is moderate. A mini-composter (a 4 × 4 × 4 foot bin) can be constructed for approximately 25 percent of the cost of a full-scale composter. Because less litter is required for operation, neither a second stage process nor a tractor-loader is needed. Cost estimates for the sheltering structure and compost bins should not exceed \$1,500 for a two-house operation.

### *Fermentation*

Fermentation is a process, used for millennia, to preserve foods and feed. Lactic acid fermentation of poultry carcasses offers growers the opportunity for converting on-farm mortalities into valuable animal feed.

Successful fermentation is accomplished by the combination of prescribed amounts of carcasses with a fermentable carbohydrate source such as sugar, whey, molasses, or ground corn. Grinding carcasses is necessary to aid the dispersion and mixing of intestinal lactic-acid-forming anaerobic bacteria which, in turn, ferment the carbohydrate source and preserve nutrients. Pathogenic microorganisms, associated with carcasses, are effectively inactivated during the

**Table 1. Economic Analyses (Annual Net Cost) Of Dead-Bird Disposal Systems For A Flock Size Of 100,000 Birds.<sup>a</sup>**

Item	Existing Technologies			Emerging Technologies		
	Disposal Pit	Large Bin Compost	Incineration	Small-Bin Compost	Fermentation	Refrigeration
	dollars					
Initial investment cost	4,500	7,500	2,000	2,016	8,200	14,500
Annual variable cost	1,378	3,281	4,833	3,661	2,862	5,378
Annual fixed cost	829	1,658	522	297	1,190	2,670
Total cost	2,207	4,939	5,355	3,958	4,052	8,048
Value of by-product	0	2,010	0	1,860	1,320	1,200
Annual net cost	2,207	2,929	5,355	2,099	2,732	6,848
Cost per hundred-weight of carcass disposed	3.68	4.88	8.92	3.50	4.55	11.41

**<sup>a</sup>Key production and financial assumptions:**

Average weight of carcass (lbs.).....	2.00	Mortality (percent).....	5.00
Length of grow-out cycle (days).....	45.00	Flocks/batches per year.....	6.00
Cost of compost removal (\$/ton).....	7.00	Labor rate (\$/hr.).....	5.00
Value of straw (\$/ton).....	60.00	Fuel/butane (\$/gal.).....	0.62
Value of litter (\$/ton).....	20.00	Tractor fuel (\$/gal.).....	0.83
Value of compost by-product (\$/ton).....	20.00	Cost of electricity (\$/kwh.).....	0.08
Value of fermented by-product (\$/lb.).....	0.02	Cost of carbohydrate (\$/lb.).....	0.07
Value of refrigerated by-product (\$/lb.).....	0.02		

fermentation process. The resulting fermented material can be stored for several months until transportation to a rendering facility is cost effective.

To adopt this method of disposal, the producer must purchase a grinder and several fiberglass holding tanks. This equipment should be housed in an open shed, approximately 10 × 14 feet. These requirements make the investment cost relatively high. Both the size of an individual's operation and the proximity to a rendering facility will determine whether fermentation is feasible.

On-farm fermentation greatly reduces transportation costs and eliminates the potential for transmission of pathogenic microorganisms. Perhaps the most impressive thing about this process is that the protein by-product is both biologically safe and a valuable feed ingredient.

### Refrigeration

Freezing poultry carcasses for short-term storage before transportation to a rendering facility is an effective method of disposal that is easily accomplished but may be fairly expensive. The expense comes from the initial cost of purchasing large-capacity freezer units and the continuous electrical costs to operate. Like fermentation, refrigeration offers the opportunity to convert on-farm mortalities into a valuable feed ingredient, assuming a rendering facility is located within a reasonable distance.

## Comparison Of Costs

### Annual Net Costs Of Disposal Methods

The annual net cost of dead-bird disposal can be used to compare alternative methods. Table 1 illustrates the net costs

of existing and emerging technologies for a flock size of 100,000 broilers. Within the existing disposal systems, initial investment for incineration is the lowest (\$2,000), with that for disposal pit being moderate (\$4,500), and large-bin composting highest (\$7,500). However, after taking other economic factors into account, including operating costs and the value of the by-product, the disposal pit method had the lowest net cost per pound of carcass disposed at 3.68¢, with composting at 4.88¢, and incineration at 8.92¢.

Emerging systems offer potential alternatives for consideration. Small-bin composting, which uses the same concept as large-bin but requires less equipment and more labor, had the lowest net cost of 3.50¢ per pound of carcass. Fermentation and refrigeration, both considered intermediate rendering processes, require relatively high

investment. After the value of the by-product was calculated, the net cost per pound for fermentation was 4.55¢ and for refrigeration 11.41¢. The high costs associated with refrigeration are directly related to electrical costs.

### Net Costs And Size Of Operation

The size of the poultry operation can also affect net costs. Figure 1 illustrates the impact operational size has on net costs (cents per pound of carcass disposed) for existing disposal methods. Because poultry operations vary in size, data for three different size operations—40,000, 100,000, and 200,000—are presented. The greatest reduction in net costs (53 percent) was with large-bin composting when going from a flock size of 40,000 to one of 200,000. Disposal pits were the least responsive to an increasing flock size with a 26 percent reduction in net costs followed closely by incineration at 30 percent. No matter which disposal method was used, larger flocks had lower net costs, and, conversely, smaller-sized flocks had higher net costs.

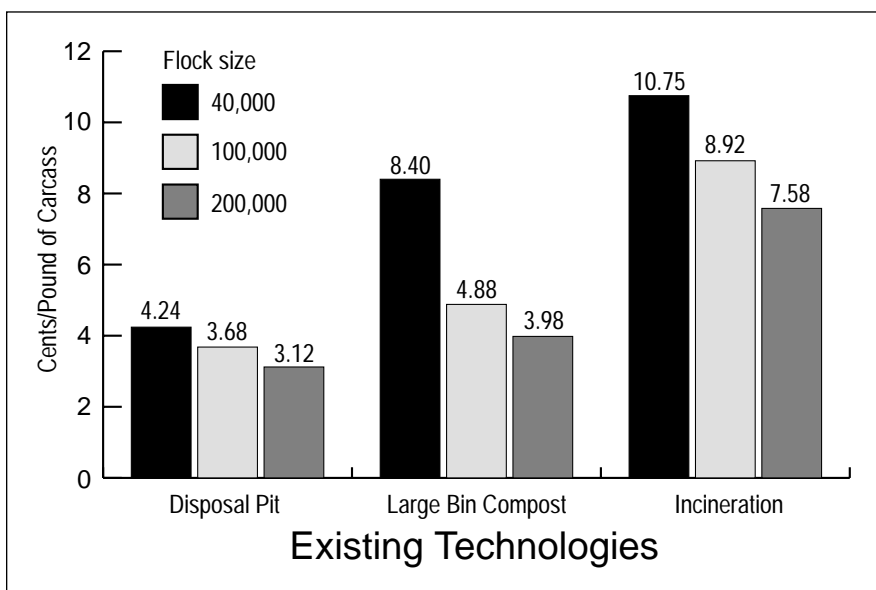


Figure 1. Net cost analysis of dead-bird disposal systems.

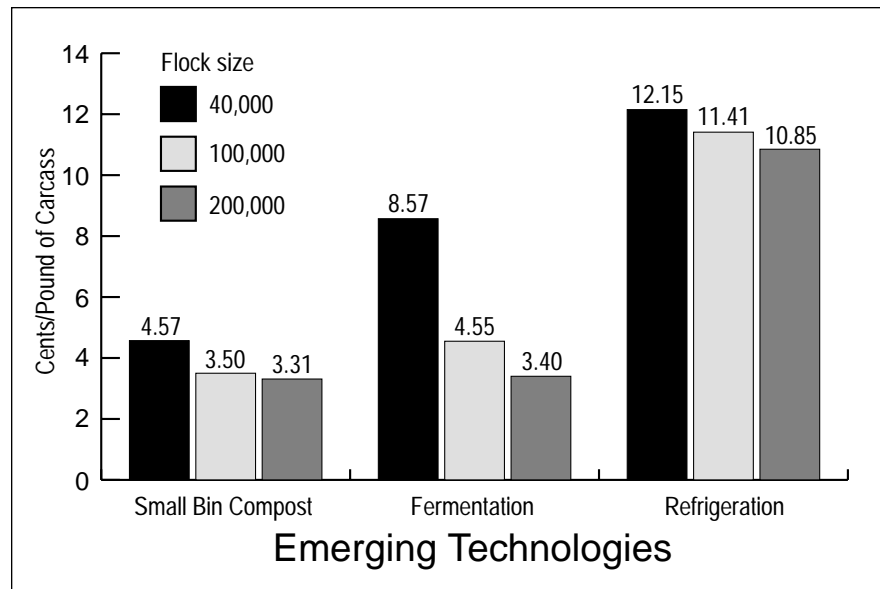


Figure 2. Net cost analysis of dead-bird disposal systems.

Figure 2 depicts similar comparisons for those disposal methods categorized as emerging technologies. The most responsive to flock size increase was fermentation. Increasing flock size from 40,000 to 200,000 reduced net costs for fermentation 60 percent, from 8.57¢ to 3.40¢ per pound of carcass disposed. The net cost of small-bin composting decreased 28 percent while refrigeration decreased 11 percent.

### Comparison Of Other Criteria

Investment and operating costs are not the only factors affecting the poultry producer's choice of a disposal system. The poultry grower must also choose from among technologies that meet biological and environmental criteria for safe and effective dead-bird disposal. Table 2 presents the economic and environmental impact of the different methods of disposal. Paramount in selecting the most appropriate method for an individual producer are management and economic considerations. Factors to evaluate include size of operation, managerial expertise, initial investment, operating costs, labor requirements, by-product value, and environmental impact.

### Summary

Among all dead-bird disposal methods there are tradeoffs in terms of resource requirements. No single method of disposal comes out the clear winner when subjected to the scrutiny of biological, environ-

Item	Existing Technologies			Emerging Technologies		
	Disposal Pit	Large-Bin Compost	Incineration	Small-Bin Compost	Fermentation	Refrigeration
Initial investment cost	M <sup>a</sup>	M	L	L	H	H
Variable cost	L	M	H	M	M	H
Fixed cost	M	M	L	L	M	H
Value of by-product	N	H	N	H	M	M
Net cost	L	M	H	L	M	H
Cost sensitivity to size	L	H	L	L	H	L
Flock size limitations	L	L	M	H	L	L
Environmental concern	H	L	M	L	N	N
Market constraints	N	L	N	L	H	H

<sup>a</sup>H=high, M=medium, L=low, N=none

mental, regulatory, and economic criteria:

- Disposal pits are economically attractive but because of regulatory constraints may not be an option in many locations.

- Large-bin composting is a proven, on-farm method to dispose of mortalities at moderate costs; however, land and management resources are critical elements in obtaining a bio-secure product that can be properly utilized.

- Incinerators are biologically efficient but energy intensive and may be viewed as a nuisance because of air pollution.

- Small-bin composting is an attractive alternative for producers who do not have the necessary equipment (tractor-loader) to handle large volumes of compost. Dependence on manual labor versus machinery may

set limits as to the size of operation for which this method is applicable.

- Fermentation could be a feasible alternative for large growers or in a situation where a central unit could be designed to serve several small producers in close proximity.

- Refrigeration is a biologically and environmentally effective method but is expensive in both initial investment and operating costs. The existence of a rendering facility to accept or pay for the by-product will place geographical constraints on the adoption of fermentation and refrigeration. Further, the fluctuation in by-product value caused by competing protein sources, such as soybean meal, for use as a feed would be an economical consideration.

## Conclusion

Management of poultry operations has become more complex as the demand for proper methods of dead-bird disposal has intensified. Any method selected by growers should meet biological, environmental, and economical criteria and at the same time reflect resources and constraints of the individual producer. Local conditions, such as soil type, weather, close proximity to residences, and availability of reliable labor can also determine the most feasible disposal method. With good information relating to all factors involved, growers can choose a dead-bird disposal method that fulfills their needs and reflects their financial situations.



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