Mortality Disposal Analysis

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Summary and Implications

Pork producers were surveyed to gather data regarding mortality disposal methods currently used in Iowa. Capital investment, labor, operating costs and satisfaction with the method used were analyzed.

Comparing capital expenses for each of the methods indicate that incineration requires the largest investment. Burial requires the least investment for most pork producers according to the survey, however, if land is not readily available, this estimation could be easily challenged. Composting bins typically require an initial capital investment, however, a large portion of the surveys indicated that a structure, formerly used for another purpose, was simply converted to composting.

Labor costs for burial exceeded labor requirements for other disposal options. Rendering required the least amount of labor because beyond removal of the carcass, no additional labor is required. Depending on the actual cost for labor or whether labor is an available resource, labor could become a critical factor in determining disposal. Composting is a very new method of disposal for most of the respondents, therefore, the labor efficiency could improve over time. This area may need to be further reviewed in several years to determine how composting efficiency changes over time.

Total operating costs were the highest for burial with composting a close second. The reason these operating costs are higher than for incineration and rendering is due to the equipment requirements for burial and composting. If the producer already owns or leases the equipment that is required for burial and composting, there would be greater justification for one or both of these disposal methods.

The total cost per 100 head marketed was the lowest for rendering, yet rendering and burial provided the least satisfaction. Total costs for composting were higher but this method resulted in the highest satisfaction level.

Introduction

With Iowa leading the country in swine production and producing in excess of 25 million hogs annually, mortality disposal becomes extremely important. Key issues such as cost, environmental impact, labor requirements, and biosecurity concerns all need to be considered when deciding on a proper disposal method. Although rendering has been the most common method of disposal, the rendering industry has been challenged with added regulations regarding the use of bone meal in feed and reduced demand for rendering by-products. These have resulted in increased costs for rendering services. In addition to the cost of rendering, biosecurity concerns have prompted livestock producers to identify other options for disposal. Incineration, burial, and composting have all become popular methods of disposal, yet each poses specific challenges. Frozen ground for burial, fuel costs for incineration, and adequate cover material for composting are all challenges for mortality disposal.

A survey was developed to gain additional information regarding disposal methods being used by pork producers in Iowa. The purpose of the survey was to determine the types of disposal methods being used, satisfaction level for each method, circumstances under which producers were using them, and key factors that lead to the selection of the disposal method(s). Continued changes in the rendering industry are anticipated and additional regulations for alternative disposal methods could occur that would affect the future trends and costs of mortality disposal.

In addition, some of the specific project objectives included identifying needs for education; uncovering unique approaches for the various methods of disposal; and comparing disposal methods in a variety of ways, including capital investment, labor, operating costs, and equipment needs. Pork producers also can use the survey results as a benchmark to compare their mortality costs, overhead, and labor.

Materials and Methods

The Iowa Pork Producer Association (IPPA) database was used for the survey. This database is maintained by the association and includes all pork producers, not just IPPA members. The types of operations or categories identified in the database include farrow to finish, grow-finish, farrow to wean, seedstock, and no data. The “no data” category includes all records identified as pork producers but for which no production information was provided. Each category was then sorted by county to ensure a geographical representation of producers throughout Iowa.

The survey was mailed the second week of March 2001 to a sample of the database that included 2,437 pork

producers. A reminder postcard was mailed on March 26. The identity of each survey respondent was confidential.

The survey included one page of general information and one section for each of the disposal methods: rendering, incineration, burial, and composting. The general information included production, location, disposal methods, and reasons for using the various disposal methods. Under each of the disposal methods, five primary areas were addressed that included the percentage of mortalities disposed under the particular method, equipment costs, service costs, labor, and satisfaction level.

Estimating Labor Costs. In an attempt to account for unavailable information for labor which was frequently missing, the average labor per 100 head marketed under each method was determined for herds with 500 head marketed and less, 501−2,000 and more than 2000. These size categories provided a common breaking point for each of the disposal methods. The average labor requirement based on 100 head marketed for each of the size categories and within each disposal method was used to estimate the labor for the operations that did not provide labor information.

Estimating Capital Costs. Before conducting the analysis, Dr. William Edwards provided benchmark information from ISU Extension publication FM 1698, *2001 Iowa Farm Custom Rate Survey*. This information was the basis for converting equipment use, capital investments, service expenses, land use, and labor requirements to actual costs of disposal on an annual basis and for factoring capital recovery. Major equipment costs used for rendering and incineration were estimated to have an average life of 10 years; therefore, an annual cost of 15% was used based on original value regardless of age. For the major equipment costs associated with composting, an estimated average life of 15-20 years was used; therefore, an annual cost of 10% was used based on original value regardless of age. The annual cost for all additional equipment investments was determined by actual cost divided by the average life. This format was used because additional equipment was very minimal and had a very inconsistent average life. The other additional equipment primarily included gas lines for incineration.

Estimating Operating Costs. The costs for services were used as indicated on the survey. The services included repairs and maintenance, fuel, rendering service, excavating contractor services for burial, and land application contractor for composting. Labor was given the cost of $12/hour. Land costs were estimated at $100/acre annually. Equipment use was given a value of $40/hour for skidloader use and $50/hour for tractors, endloaders, trenchers, and backhoes.

To compare each of the methods, the operating costs, labor, and capital investments were converted to a total cost per 100 head marketed. Because many of the surveys indicated that they use a combination of disposal methods, the survey asked for the percentage disposed of by each disposal method. The same percentage was used to determine number of head marketed based on the specific disposal methods, which was used to establish the cost per 100 head marketed.

Results and Discussion

The total number of surveys returned was 452 with 299 useable (still in business) and 153 out of production. The 299 surveys represented operations from 82 counties.

Table 1 gives the percentage of respondents who use each of the disposal methods or a combination of one or more methods.

Table 1. Percentage of survey respondents using a single disposal method or combination of methods.

Method/Combination	Producers, %
Rendering	32
Composting	18
Rendering/Burial	16
Burial	5
Rendering/Incineration	5
Rendering/Composting	5
Incineration	5
Rendering/Burial/Composting	3
Burial/Composting	2
Other combinations	6

Thirty-two percent of the surveys indicated that rendering alone is the method of mortality disposal being used, composting alone followed second with 18%, and the combination of rendering and burial was third with 16%. After adjusting the weight of the surveys based on the original demographic information by operation type, 35% of Iowa's pork producers are using strictly rendering, 17% are using a combination of rendering and burial, and 12% rely strictly on composting.

Table 2 illustrates the primary disposal method based on the type of production or operation type. For example, incineration is not typically the chosen method of disposal for farrow to finish, feeder to finish and wean to finish operations. On the other hand, composting and rendering appear to be utilized by producers involved in all types of systems.

Table 2. Disposal method by operation type.

Operation Type	Rendering	Incineration	Burial	Composting	Other
Farrow to Finish	29%	6%	26%	35%	3%
Feeder to Finish	57%	5%	13%	23%	2%
Wean to Finish	51%	5%	17%	27%	0
Farrow to Feeder	29%	29%	25%	18%	0
Farrow to Wean	48%	11%	11%	30%	0
Seedstock	39%	28%	6%	28%	0

The factors for determining the type of disposal method had the options of cost, time, disease, and other with 43% basing their decision on cost, 39% on time, 20% on disease, and 8% other which included convenience, service, practical, simple, odor, sustainable, availability, company determines, trying new ideas, lack options, and season.

Of the 113 surveys that indicated they use a combination of methods, 86 listed additional comments regarding their reasons for using a combination. Fifty-two of the 86 (60%) associated the use of a disposal combination with the size of the animal. The primary combination was rendering large carcasses and incineration, composting, or burial of small carcasses. Twenty-five of 86 (29%) indicated that the combination had to do with seasonal challenges. Other responses referred to multisite production, disposal methods that work best with each site, and timing of the rendering truck arrival.

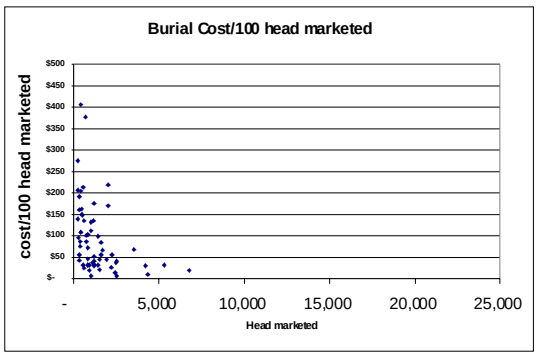
Ninety-eight percent (293) of respondents have rendering available in their area. A total of 209 indicated that even though rendering is available, they still use other method(s). Of the 209, 132 (63%) indicated that rendering is too expensive, 21 (10%) indicated that rendering service was not available when needed, 45 (22%) have concerns about disease, and 11 (5%) other, which included render large pigs only and incinerate small pigs, timing, unreliable, and future availability.

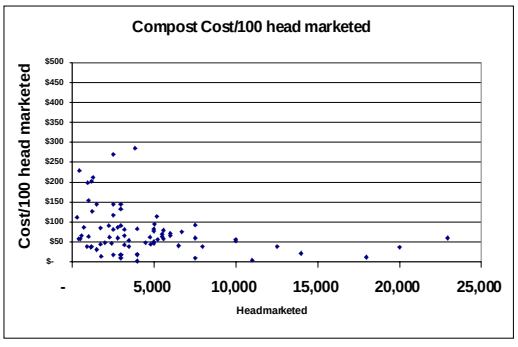
Sixty-one of the surveys provided written comments of additional information that they would like to see regarding mortality disposal. Over one-half (34 of 61) indicated that they would like additional information regarding composting. Fifteen suggested how they would like to receive new information, including ISU Extension programs and farm magazines, and eight requested general information regarding disposal and costs.

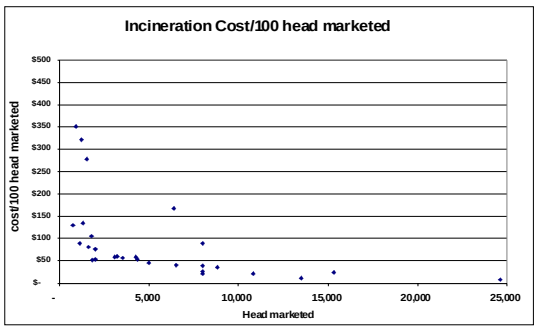
When comparing the disposal methods, rendering was identified as the low-cost method with composting and incineration a close second and third.

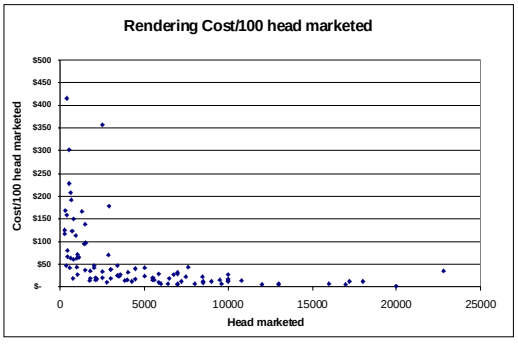
Incineration seemed to be used primarily for smaller pigs based on the comments provided in the general information. At the same time composting was by far the most satisfying method being used.

The following charts show the diversity of average costs for each of the surveys based on a cost per 100 head marketed. Rendering indicates the least amount of fluctuation, whereas the other disposal options show a larger degree of inconsistent costs based on the survey information.









When converting the cost of disposal to cost per 100 head marketed, it was necessary to determine the percentage of total marketed based on the use of each disposal method. This conversion potentially resulted in skewed information for the operations that use any of the disposal methods on a very small scale. For example, for an operation that markets 2,000 head annually and renders 90% of the mortalities and composts the remaining 10%, estimates of labor, equipment use, and capital investment for disposal by composting based on 200 head annually (10% of 2,000 marketed) have the potential to be biased. Information regarding other species being disposed of at the same time was not collected. Additionally, composting may be designed to compost items and products along with the mortalities, i.e., bedding and manure from hoop barns. The labor requirement in this case would increase significantly to deal with the products in addition to the mortalities.

Table 3 gives a detailed comparison of disposal methods for herds marketing more than 200 head annually. The number of head marketed is based on the percentage of each disposal method used.

Table 3. Comparison of disposal methods – More than 200 head marketed annually (number of head marketed is based on percentage of disposal method used).

Disposal Method		Capital Expense/100 Marketed *(Non-annualized)*	Labor Cost/100 Marketed *($12/hour)*	Operating Cost/100 Head *(Includes machinery and land use)*	Total Cost/100 Marketed *(Includes annualized capital expense)*	Satisfaction Level, 1-High,5-Low
Rendering	Count	105	105	105	105	
	Average	$1.29	$16.12	$31.99	$48.31	2.06
	Minimum	-	$0.31	$0.80	$1.19	
	Maximum	$50.00	$156.00	$260	$416.00	
Incineration	Count	29	29	29	29	
	Average	$107.10	$32.04	$28.27	$85.90	1.86
	Minimum	$8.13	$0.56	$0.89	$3.95	
	Maximum	$736.67	$138.67	$133.33	$350.06	
Burial	Count	65	65	54	65	
	Average	$0.12	$52.02	$70.80	$110.96	2.44
	Minimum	-	$0.92	$2.31	$5.31	
	Maximum	$4.08	$499.20	$592.59	$685.38	
Composting	Count	78	78	67	78	
	Average	$6.78	$23.51	$58.32	$74.35	1.66
	Minimum	-	$1.42	-	$1.61	
	Maximum	$105.77	$96.00	$252.11	$284.67	

Rendering

A total of 194 surveys indicated that producers use rendering in their operations. Although some information was useable from each of the surveys, 105 provided adequate information to determine true cost of disposal. Rendering is used 100% of the time by 45% of rendering responses. Based on all of the respondents who use rendering at some point, this method accounts for 75% of the mortalities.

Capital Investment. Eleven percent or 21 of the responses made an investment in additional equipment. The cost of equipment ranged from $20 for barrels to store pigs to $11,000 for refrigerated storage. The average cost for additional equipment in the 21 surveys was $1,704.29. The average yearly cost (15% of capital investment) was $255.64/operation.

Operating Cost. Rendering charges ranged from $0 to $50 with an average of $16.93. The most frequent charge was $20. Of the 121 that responded to the number of visits per week, the average was 1.13 visits per week. The average cost per year for rendering service was $774. For operations marketing over 200 head annually the average operating cost was $31.99/100 head marketed.

Labor. Labor information was provided by 128 respondents. The average labor requirement/week was .86 hours. The minimum was 0.01 and the maximum was

10 hours/week. Based on the labor requirements provided by the 128 surveys at a cost of $12/hour and considering the number of head marketed, the cost per 100 marketed for all operations averaged $28.38; however, the average cost improved to $16.12 for operations marketing more than 200 head annually.

Total Cost. Total cost for rendering per year averaged $966.35. The average cost per 100 head marketed for all operations came to $83.56. A total of 115 of 194 surveys provided adequate information to determine the actual cost of rendering per 100 marketed. It was obvious that the operations that marketed less than 200 annually skewed the average cost significantly. By relying on the operations that marketed more than 200 head based on disposal method, the average cost per 100 marketed was $48.31. To compare actual rendering costs one can use the following formula where the cost/visit, labor/week, cost of labor, investment, and visits/week can each be adjusted:

[((visits/week X 52 X cost/visit) + (hours/week X 52 X labor cost/hour) + annual cost for capital investment)) / total marketed/year] X 100 = cost/100 head marketed.

Satisfaction. Satisfaction level was asked for each method of disposal. The options for satisfaction included very satisfied (high), moderately satisfied, neutral, moderately dissatisfied, and very dissatisfied (low). The rendering method averaged 2.06 with (1-high and 5–low), based on the operations marketing more than 200 head annually.

Problems. Problems were identified by 88 of 194 respondents that use rendering. Forty referred to poor service, 40 referred to cost, five referred to good service but concerned about future service and availability, and three referred to disease potential.

Incineration

Forty-eight surveys reported that they use incineration as a disposal method. Nineteen of 48 producers did not provide essential information that would contribute to the final cost for the disposal method. Three of the 19 indicated that they simply use a burn pile rather than an incinerator to burn carcasses. The other 16 did not provide incinerator model, annual fuel expense, or maintenance expense and, therefore, the information was not incorporated into the analysis because it was difficult to determine whether an incineration method was truly being utilized.

The size or range of carcasses was not consistent from the surveys.

The type of incinerators named in the survey included Burn Easy, R & K, Lewis, 3 Round Lined, Own, R & D, and manufactured locally.

Capital Investment. Capital investment was provided by 25 of 29 usable surveys where a purchase price was provided. Estimation was made for the remaining four based on the average price of the specific brand or based on the total average if no brand was provided. The minimum price provided was $500 and the maximum price was $9,950. The most frequent price was $3,000 with an average price of $2,653.75. The price per year was estimated as 15% of the actual cost.

Additional investments averaged $214.78 with a minimum investment of $10 and a maximum of $500. The average for total capital investment was $2,818.42. The minimum investment was $500 and the maximum investment was $11,050.

Operating Cost. Information regarding fuel indicated that 24 of 29 incinerators use diesel fuel with the others relying on fuel oil and kerosene. Unreported fuel costs were estimated based on the average cost per 100 head marketed from the group of surveys that reported fuel costs. The average annual fuel cost was $778.29 and the average fuel cost per 100 marketed was $26.50.

The average maintenance cost was $150. Eight surveys did not provide maintenance cost information and the average of $150 was incorporated in the surveys missing maintenance information to estimate the cost per 100 marketed. The minimum cost was $20 with a maximum of $300 and the most frequent response was $150.

Labor. Labor information was provided by all 29 useable surveys. The average labor per week was 1.6 hours with a minimum of 0.06 hours and a maximum of 10. Converting the labor requirements to an annual basis gave an average of 83.2 hours/year and a minimum of 3.12 hours/year and a maximum of 520 hours/year. The average cost of labor was $1006.93 with a cost of $32.04/100 head marketed.

Total Costs. Total costs for the year averaged $2,600, with a minimum of $967 and a maximum of $10,700. The average cost per 100 marketed was $85.90 with a minimum of $3.95 and a maximum of $350.06.

Satisfaction. Satisfaction level for incineration averaged 1.86 (1-high and 5-low) by the operations marketing more than 200 head annually.

Problems. Problems were identified by 18 of the useable surveys. Eight referred to maintenance and fuel, six identified costs as a problem, three referred to the procedure for incineration as a problem, and one identified weather as a problem.

Burial

The burial method was used by 94 of the respondents and was used to dispose of 51% of their mortalities. Of the 94, 37 did not provide information pertaining to the type of burial (trench or pit). Of the remaining 57 respondents, 28 (49.1%) use a trench, 27 (47.4%) use a pit, and two (3.5%) use a combination of a pit and a trench.

Operating Cost. Land requirement for burial appears to be very minimal. The average trench is 94 feet/year, 48 inches wide, and 63.5 inches deep. The most common trench length was 30 feet/year, 24 inches wide, and 48 inches deep. The average pit was 24.9 ft X 16.1 ft and 55

inches deep. The most frequent pit dimensions were 10 ft X 6 ft and 36 inches deep. The average land requirement was 0.0251 acres. The average land requirement per 100 head marketed was 94.26 square feet. The conversion to the average cost for land annually was $2.51 based on $100/acre.

Nine out of the 94 respondents indicated that they hired a contractor to dig or fill in the pit or trench. The average cost for the contractor service was $173 with a minimum cost of $45 and a maximum cost of $210.

Machinery costs were provided by 69 of 94 respondents who use machinery for burial. The average cost for equipment that included tractors, trenchers, and backhoes @ $50/hour and skidloaders @ $40/hour was $541.47 based on 11.73 hours/year. The average operating cost for all operations was $146/100 head marketed, however the average operating cost improved to $70.80/100 head for operations marketing over 200 head annually.

Labor. Responses indicated that smaller operations used more labor for burial. It appears that the cost to dig a trench or pit remains consistent regardless of size. Labor was not provided by 39 of 94 surveys. The estimates for labor requirements not provided were based on the average labor per 100 head marketed for operations marketing 500 and less, 501–2,000 head and more than 2,000 head.

Based on the actual labor reported, the average labor required was 0.57 hours/week, which accumulated a cost of $355.73. After incorporating labor estimates, total labor required per year is 29.75 hours. The average labor cost per 100 head marketed was $52.02 for the operations marketing over 200 head annually.

Total Cost. Total cost for burial disposal included labor, machinery, contractor, and land. The cost per 100 marketed came to $197.98/100 head marketed. The average cost for operations above 200 head marketed annually based on the percentage of mortality disposal method averaged $110.96.

Satisfaction. Satisfaction with the burial method averaged 2.44, (1-high, 5-low) for all operations marketing more than 200 head annually.

Problems. Problems were identified by 43 of 94 surveys. Frozen ground was referred to by 14, equipment and labor were problems for 16, eight referred to dogs and other animals, location was a problem for six, and three identified other such as cost and rules.

Composting

Ninety-six respondents indicated that they use composting for mortality disposal on their operations. Of the responses, composting was used to dispose an average of 80% of the mortalities.

Composting Method. The type of composting was identified where 20 use composting bins, 42 windrows, and 29 other. The other category includes piles, concrete containment, barrels, around square bales, around fence, in barn, and silo pit. Of the 20 responses that use bins, five were newly constructed and nine converted. Sixteen were constructed or converted by themselves and two were constructed or converted by a contractor. The number of bins ranged from one to four (one bin – 3, two bins – 8, three bins – 3, four bins – 6). The bins were constructed between 1968 and 2000 with most constructed after 1997. The materials for construction were primarily concrete which made up 11 of 19 respondents, wood – 5, bales – 1, dirt – 1 and a combination of wood and concrete – 1.

Construction costs were provided by 27 respondents. The construction of the compost facility had an average cost of $1,404.63.

Ninety of 96 respondents indicated whether a roof was provided for their structure. Seventy-seven or 85.5% did not have a roof, 12 or 13.3% had a permanent roof, and one had a temporary roof.

Of the 42 respondents that use windrows, 39 provided dimensions of the windrows. The average length was 50 feet and 26 feet in width. The average amount of land required for windrows from the 39 respondents was 0.046 acres or 2,013 square feet. The average amount of land per 100 head marketed was 86.1 square feet. The average land cost for windrows was $4.60.

The question of placing the compost on a surface was answered by 89 of 96 respondents. Forty-six (51.7%) used compacted earth, 34 (38.2%) used concrete, one (1.1%) used asphalt, one (1.1%) used rock, five (5.6%) used limestone, and two (2.2%) used other, which included cornstalks and dirt.

Operating Costs. Additional equipment was being used by 72 of 96 respondents. The 72 respondents reported 129 different pieces of equipment such as skidloaders, tractors, etc. The minimum cost was $10 and the maximum cost was $10,000 for the annual use of the equipment. The average use cost for each of the 129 pieces of equipment used by the 72 respondents was $1,061.20.

Cover material information was provided by 63 respondents. Cornstalks were the most common material used by 37 (59%) respondents. Various forms of sawdust and by-products are or have been used by 34 (54%) of the producers. Twenty-two (35%) of the producers have used straw. Twenty-four (38%) of the producers have used other products of which most consisted of a form of manure. Other materials included grass clippings, newspaper, and corncobs.

Seventy-eight of the producers responded to identifying how they get cover material. Forty-seven of the 78 (60%) produce their own. Twenty-nine (37%) purchase the product, and two (2.6%) indicated that they do not use any.

Seventy-eight producers responded to the method of storage of cover material. A total of 67 producers (86%) store the material outside with no cover over the material.

Six (7.7%) store the material as part of the bin system. Five (6.4%) store the material in a separate building.

Fifty respondents provided an annual cost of the cover material. The average annual cost of cover material was $450.50. The lowest cost was $0 and the most expensive was $6,000. The most frequent was $100.

The average operating cost for composting was $58.32/100 head marketed for operations marketing more than 200 head annually. Operating costs included equipment and cover material custom applicators for compost material.

Capital Expenses. Expenditures were reported by fifty-seven of 94 respondents which included new construction and conversion for composting bins. The average cost for the major capital expenditures was $668.50. The average cost per 100 head marketed for operations marketing more than 200 head per year averaged $6.78.

Labor. Information was provided by 74 of 96 respondents. The average labor per 100 marketed was just over three hours. To estimate the labor for the operations that did not provide labor information but did provide number marketed, the average labor per 100 marketed was used for the operations marketing under 500, 501−2,000 and more than 2,000 head. The average amount of labor required for compost disposal was 1.3 hours/week, based on actual information provided. The average cost of labor was $723.45 annually, which includes estimated labor. The highest labor cost was $3,120. The average cost per 100 head marketed was $23.51 for the operations marketing more than 200 head annually. Four of the 96 respondents indicated that they contract with someone else for spreading the finished compost. The average cost for spreading is $512.50.

Total Cost. Total cost for composting mortalities averaged $2,416.70. The most expensive cost for composting was $13,624. The average cost per 100 marketed for all operations was $116.03. The average cost for an operation marketing more than 200 animals annually was $74.35.

Satisfaction. The average satisfaction level was 1.67 (1-high and 5-low) based on the operations marketing over 200 annually.

Problems. Composting problems were identified in 33 of the surveys and an additional 12 surveys pointed out how well composting is working for them. Frozen piles has caused problems for 15 of the surveys, six indicated problems with animals, and three identified problems with large bones, three referred to their structure, and one mentioned the need for larger equipment.

References

1. Edwards, W. 2001 Iowa Farm Custom Rate Survey. ISU Extension publication FM 1698.

2. Bitney, L. Disposal Methods of Livestock Mortality, NebGuide G01-1421-A.