RESULTS OF TCFA ENVIRONMENTAL AND ENERGY SURVEY - 1979

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(65 FEEDLOTS RESPONDING)

Part A. Summary

The Texas Cattle Feeders Association in cooperation with the Texas Agricultural Extension Service, conducted an Environmental and Energy Survey in January-March, 1979. Responses were received and compiled from 65 feedlots ranging in size from 2400 to 90,000 head capacity (24,000 head average).

Despite the fact that feed yards have installed adequate water pollution control systems, general improvements could be made in maintaining these systems. Many of the feedlots should consider accelerated dewatering schedules, additional land for runoff disposal, use of dilution water, installation of solids settling (debris) basins, and solids removal from runoff holding ponds. A sound, economical method of settled solids removal needs to be developed.

Most feedlots still use only the wheel loader for manure collection, despite the fact it is the most energy intensive system available. Most feedlots now have a manure inventory problem. The price, availability, and apparent demand for manure vary enormously among feed yards. The cost averages $1.58 per ton plus 16¢ per ton-mile, as delivered to the farmer and spread. The cost of manure is considered the most important factor in marketing feedlot manure, yet some feedlots charge more than it is probably worth and some charge a lot less.

Tremendous variation exists in the amount of land that feedlots have available for manure disposal and in annual manure sales to farmers. Application rates are generally in the 10-14 ton per acre range for a wide variety of crops.

Feedlots appear to be very knowledgeable about fly and odor control practices that are currently available. These practices, consisting largely of "good housekeeping", are being widely used by feedlots. Basic principles such as good drainage are being followed. Odor control chemicals are not used except for holding ponds. While most feedlots acknowledge that dust is an annual problem, they only treat the roads and not the feed pens, despite readily available technology for water application. Almost all feedlots utilize one or more forms of pesticide treatment for fly control.

Feedlot managers are optimistic about the future benefits of fuel gas (methane) production for manure, but are pessimistic about refeeding manure in a fattening ration. Mechanical handling systems and processing costs were cited as the major obstacles to manure refeeding, followed closely by nutritional characteristics, legal and social constraints, and feeder/customer acceptance.

Most cattle feedlots have unheated, float systems for water supply, and they clean these water troughs once or twice weekly. There is no apparent industry norm for drinking water storage capacity. Nearly all feedlots are on groundwater.

Number of feed trucks per unit of feed yard capacity exhibited a surprisingly wide variation. Gasoline trucks far out number diesel trucks.

Acid treatment of grain is used by only 1/5 of the feedlots. Steam flaking of grain is widely used and entails energy consumption of 110,000 BTU/head capacity/month (85 percent natural gas, 15 percent electrical power). Dry heat treatment of grain requires slightly less energy (106,000 BTU per head per month), and essentially the same natural gas consumption as steam flaking. Feed yards are paying $1.62 per mcf (1000 cu ft) for natural gas and 3.7¢ per kilowatt-hour (kw hr) for electricity.

Part B. Discussion of Responses

I. Runoff Control Systems

1. More than 2/3 of the feedlots have man-made runoff holding ponds; the other 1/3 use playas for runoff collection and storage.

2. Holding ponds and playas averaged 29 percent full; the majority of feedlots are keeping them pumped down below 25 percent full, above which the TDWR wants them dewatered in 14 days.

3. Coupled with question #2, the 46 useable responses indicated that three feedlots were doing an excellent job of keeping ponds empty despite rains; 29 feed yards were doing well, while 14 need to speed up their dewatering process.

4. There was huge variation in land area available for runoff disposal. Some 23 feed yards had less than the 1:1 ratio of disposal area to feedlot area recommended for High Plains; 17 feed yards were between 1:1 and 4:1 (good practice); and 17 feedlots had abundant disposal area (more than 4:1 ratio).

5. Most feedlots (64 percent) do not use dilution water to reduce salt content of feedlot runoff. Of those that do, dilution ratios average less than 2:1, not enough to reduce salinity of holding pond water to crop tolerance levels in many cases. Annual testing for salt is recommended.

6. Three-fourths of the feedlots apply less than six inches of feedlot runoff (undiluted basis). Ten inches is the maximum recommended from forage yield experiments.

7. Less than half the feedlots have installed runoff settling facilities, despite the fact that up to 80 percent of the suspended solids can be removed by properly designed systems. Settling basins or flat, baffled channels are the best.

8. Settled solids are infrequently or never cleaned from holding ponds or playas in most cases. By contrast, the majority of those who have settling channels or basins generally maintain them. Perhaps this is because maintainence is easier and/or more obviously needed.

9. There is no consensus on how to clean solids out of a runoff holding pond or playa. The wheel loader is used most often with dragline the next choice. The hydraulic dredge has not caught on yet. (Actually one responding feedlot has used it but the new owners are not aware of it.) Settling basins or channels are cleaned out with wheel or track loaders, draglines, and dozers.

II. Solid Waste Management Systems

1. Contractors collect manure at 2/3 of the feedlots, and they haul manure at 4/5 of the feedlots. Feedlot personnel and equipment are frequently used to collect manure, but are not usually involved in hauling and spreading.

2. Manure is collected once or twice a year at 83 percent of the feedlots. At many feedlots, manure is collected from the concrete apron behind the feed bunk about twice as frequently as from the dirt lot surface.

3. The wheel loader is by far the most popular equipment for manure collection and loading. At 70 percent of the feedlots, it is used alone without prior surface preparation such as plowing or disking. Chisel plowing is used at 16 percent of the feedlots followed by collection with the wheel loader. The elevating scraper is used at only four percent of the feedlots at this time.

   Energy requirements for manure collection, loading and hauling/spreading were estimated for feedlots based on the type of collection equipment reported, published data from collection and loading experiments, and certain assumptions. Average energy requirements were estimated at 3.2, 1.6, and 24.6 hp hours/year/head of feedlot capacity for collection, loading and hauling/spreading, respectively. The total manure handling energy consumption estimate of 29.4 hp hours/year/head (or 16 hp hours/ton) represents only 6 percent of the energy replacement value of feedlot manure (societal benefits) when substituted for commercial fertilizer.

4. The majority of feedlots had a manure stockpile in 1978, but the size of stockpiles was widely variant. Of the feedlots with a stockpile, the amount averaged 0.8 tons per head capacity, which represents nearly six months backlog. Some feedlots that reported no stockpile noted that manure is stockpiled (stacked) in pens for extended periods of time. This actually is a form of stockpiling, so the inventory (backlog) could be considerably higher.

5. Tremendous variation exists in the price of manure. As regards net revenue to the feed yards, six feedlots are actually paying haulers to take it, 22 feedlots are giving it away, and 23 feedlots are deriving income of 25¢ to $3 per ton (43¢ per ton average).

   Cost of manure to farmers also varies tremendously. Forty-three lots gave 33 different price formulas! Is this sound marketing strategy?

The average price of $1.58 per ton plus 16¢ per ton-mile means that manure costs $3.18 per ton for a ten mile haul (one-way). In comparison with fertilizers containing both nitrogen and phosphorus, that is about what manure is worth the first year, but only about half what its worth overall considering the residual nitrogen benefits. But feedlot manure is now twice as expensive as anhydrous ammonia.

A ten ton per acre application now would cost the farmer $23.80 per acre if he is five miles away and $39.80 per acre if he is 15 miles away, assuming the average price formula. By comparison, most farmers like to limit fertilizer costs to $20-25 per acre, but they will pay more on land they feel needs the organic matter and micronutrients. (For example, crops on irrigated, sandy soils and calcareous soils usually respond extremely well to feedlot manure.)

The highest cost formulas appear excessive to generate consistent farmer demand from more than five miles away. How many farmers will pay $100-$200 per acre for fertilizer?

6. Feed yard managers believe that "equipment maintenance" and "leaving smooth pen surface" are the two most important factors in manure collection. Mounding is viewed with mixed emotions; some believe in it and some do not.

III. Land Disposal

1. The 65 feedlots have 85 acres of land available for each 1000 head of feedlot capacity. This average acreage is deceiving, however, as it ranges from zero (15 feedlots) to 1100 acres per 100 head for one small feedlot.

2. Most feedlots apply about 10 to 20 tons per acre per year to their own land. This corresponds to the rate recommended from research in the Texas Panhandle. A few apply as much as 40-50 ton/acre/year, which is acceptable on sandy soils.

3. The amount of manure sold to area farmers ranges widely, averaging 16,000 tons per feedlot, or 0.66 tons per head of feedlot capacity annually. This is only 1/3 of the collectable manure expected from a feedlot operating near capacity.

4. Farmers generally apply 10-15 ton of feedlot manure per acre annually for most crops. The highest rate used by farmers about 40 tons per acre per year.

5. Cost of manure and distance to cropland are the most important factors in selling manure to farmers. These two factors are definitely related. Seventy percent of the feedlots felt they were highly important while only 4 to 5 percent attached little importance to them. By contrast, salt content, nutrient content and weed seed potential are of secondary importance in selling manure to farmers.

IV. Dust, Odor, and Fly Control

1. Over half the feedlots indicated that feedlot dust is an annual problem, while 20 percent perceive dust problems periodically. Only 26 percent felt dust is never a problem. No differentiation was attempted between dust as an environmental vs. a cattle health problem.

2. Most of the feedlots (63 percent) try to control dust from roads by paving, gravel, oil, or water application. By contrast, 57 percent of the feedlots make no attempt to control feed pen dust, and only 18 percent use water application methods, which have proven effectiveness. (Recommendations on water application for dust control were made by TCFA and the Texas Agricultural Extension Service in 1972 and 1974, and published reports are available.)

3. The most frequently used method of odor control is "good drainage" which also received the highest effectiveness rating (justifiably). Rapid pump down of runoff holding ponds and frequent manure collection are frequently used and are rated effective. Watering system maintenance is another effective odor control tool. The least effective and least used odor control method, according to the feedlots, are odor control chemicals/biochemicals and masking agents. Chemical treatment is more often used, and perceived to be moderately effective, in runoff holding ponds. Few feedlots practice "collecting surface manure layer only", probably because they do not have the necessary equipment (elevating scraper, box scraper, road grader, etc.) as evidenced in a previous section.

4. All 13 fly control methods listed were rated effective. The most popular methods were pesticide treatment (spraying/fogging) along feed bunks and around feed mills, cleaning along feed bunks, and maintenance of watering systems (pipes, troughs). The two best methods (by scant margin) involved keeping wet spots from occurring: correcting pen drainage and repairing water lines and troughs. Manure removal from pens or places that have manure but little cattle traffic were judged to be effective fly control measures.

5. Most of the feed yards use fly bait and either ground foggers or ground sprayers for chemical control of flies. A few use aerial application, hand sprayers (presumably spot treatment), and other methods. Chemicals are usually applied once or twice weekly.

V. Manure Processing and Utilization

1. Most cattle feedlots believe fuel gas production would be the most beneficial use of manure. Several noted that they have signed contracts to supply manure to plants slated for construction "soon".

   By contrast, refeeding manure is held in low regard by most feed yards. For instance, 75 percent gave a low rating to feeding cattle manure while only nine percent gave it a high rating. Potential methods of processing manure for feeding - ensiling and chemical

preservatives - were unfavorably rated by 77 percent and 92 percent of the feedlots, respectively.

2. The major obstacles to feeding animal manure were cost and mechanical systems for processing and handling. Residue and disease potential were judged the least obstacles but worthy of consideration. Nutritional properties of manure and legal/consumer/customer acceptance were rated as appreciable obstacles.

3. Potential benefits of refeeding animal manure do not outweigh the problems according to 72 percent of the feedlot managers reponding.

VI. Water Supply System

1. Float systems are used by more feedlots than continuous overflow watering systems. At least ten of the feedlots have both systems, presumably with continuous overflow systems in newer sections of the feedlot. Water supply requirements for continuous overflow systems averaged 2.8 gpm per trough, within the wide range of 1/4 to 10 gpm per trough. Continuous discharge to the holding pond could be considerable at times when cattle are not drinking (e.g. 350 gpm for a 25,000 head feedlot).

2. Most feedlots (73 percent) use unheated water troughs while only a few (4 percent) use both heated and unheated. Electric heaters are more popular by far than gas heaters.

3. Some 84 percent of the feedlots clean out water troughs either once or twice weekly, while 10 percent perform this chore daily and two percent clean them out overy six months.

4. The amount of water stored in water storage tanks at feedlots varies tremendously from zero to 564,000 gallons one-time capacity. This figures out to 0-17.7 gallons water per head of capacity. The average storage capacity is 59,000 gallons, or 4.1 gallons per head. Individual storage tanks are present in a wide variety of sizes and shapes.

5. None of the water storage tanks are heated.

6. Nearly all feedlots (92 percent) are supplied by groundwater, exceptions being city water, surface water impoundments, and irrigation canals.

7. The average depth to groundwater in water supply wells is 318 feet (65-1500 ft range). This statistic is important not only from the standpoint of total energy consumption at feedlots but also because it indicates that chances of groundwater contamination are relatively remote.

VII. Feed Distribution System

1. Two-thirds of the feed yards feed cattle twice daily and 25 percent supply them with feed three or four times daily.

2. Feed bunks are cleaned at least once a week in most cases (64 percent), while 27 percent of the feedlots indicate feed bunk cleaning on an "as needed" basis.

3. Bunk cleaning is performed either by manual labor or with a rotary brush bunk cleaner, or with both.

4. Very few feed yards (only eight percent) have installed batter boards to prevent migration of medicated feeds in rainfall that enters the feed bunk.

5. The number of feed trucks averages 3.3 per feedlot (1 - 10 range). This figures out to 2.1 trucks per 10,000 head of feedlot capacity on average (1.4 trucks per 10,000 head median value). Two small feedlots have eight and 14 trucks per 10,000 head, while one 50,000 head feed yard has only 0.4 trucks per 10,000 head capacity. Gasoline trucks are in a 3:1 majority over diesel trucks.

VIII. Feed Processing System

1. Only 20 percent of the feedlots use acid treatment of grain.

2. Most feedlots (71 percent) provide steam flaking of grain.

3. Total energy consumption for steam flaking averaged 111,000 BTU/head/month, while dry heat requires 106,000 BTU/head/month. Natural gas requirements for steam flaking and dry heat are identical at 93,000 BTU/head/month, or 93 cu ft of natural gas/head/month. Consumption of electrical energy for grain processing averages 5 kw hr/head/month for steam flaking and 4 kw hr/head/month for dry heat.

   Feed yards are currently paying an average of $1.62/mcf for natural gas, 3.7¢/kw hr for electricity, and 32¢ per gallon for LPG.

Part C. Tabulated Results

I. Runoff Control Systems

1. What type of facility is used for collection/storage of feed yard runoff?

	No. Feed Yards	Percent
Playa lake	17	26
Man-made holding pond	45	69
Both playa and holding pond	1	2
Evaporation pond	1	2
Field sink	1	2
Totals	65	101

2. What percent of the design capacity of holding ponds or playa lakes would be available for runoff storage if it rained today?

	No. Feed Yards	Percent
0 to 25%	3	5
25 to 50%	7	11
50 to 75%	17	27
75 to 100%	35	56
Totals	62	99

3. What was the date and amount of the last rainfall? (49 feedlots)

	Average	Range
Rainfall Amount, inches	1.11	0.01-11.0
Runoff (=Rainfall-0.5 inches), inches	0.73	0.10.5
Days Since Last Rainfall, days	39	0-240

4. How much land is available for runoff disposal?

	Average	Range
Land for Runoff Disposal, acres	529	2-12,000
Disposal Area per 1000 hd capacity	42	0.03-510
Ratio: Disposal Area/Feedlot Area	9.2	0.01-110

5. Is dilution water mixed with feedlot runoff to manage salt concentrations for land disposal?

	No. Feed Yards	Percent
Yes	21	36
No	38	64
Totals	59	100

Dilution Ratio (water to feedlot runoff):

	Average	Range	Median
All Feedlots	0.5:1	0-5:1	0
Feedlots w/Holding Ponds only	0.6:1	0-5:1	0

6. How many inches per year of feedlot runoff (undiluted basis) do you typically apply to soils?

	No. Feedlots	Percent
0-2 inches	21	36
2-4 inches	11	19
4-6 inches	14	24
More than 6 inches	13	22
Totals	59	101

7. What type(s) of solids settling facilities or structures are installed between the feed yard and the holding pond or playa? (64 feed yards responded)

	No. Responses	Percent of Feedlots*
None	34	53
Settling basin	15	23
Flat channel	10	16
Vegetated waterway	9	14
Flat channel w/baffles or dams	6	9
Other	0	0

*Adds to more than 100 percent because of multiple responses.

8. How often are solids removed from:

   a. Holding Ponds or Playa Lakes?

	No. Feedlots	Percent
Never	25	45
After every major storm	0	0
Every year	4	7
1-2 years	6	11
2-5 years	8	14
5-10 years	8	14
10 years or more	5	9
Totals	56	100

b. Settling channels or basins?

	No. Feedlots	Percent
Never	8	24
After every major storm	3	9
Every year	14	42
1-2 years	3	9
2-5 years	5	15
5-10 years	0	0
10 years or more	0	0
Totals	33	99

9. What type of equipment was used for removal of settleable solids from: (54 feedlots responded)

a. Holding Ponds?

	No. Responses	Percent of 54 Feedlots*
None	24	44
Dragline	8	15
Hydraulic dredge (Mudcat)	0	0
Wheel loader	12	22
Track loader	2	4
Dozer	5	15
Elevating (paddle) scraper	3	6
Standard wheel scraper	2	4
Road grader	0	0
Other	3	6

*Adds to more than 100 percent because of multiple responses.

b. Settling channels or basins? (34 feedlots responded)

	No. Responses	Percent of 34 Feedlots*
None	7	21
Dragline	5	15
Hydraulic dredge	0	0
Wheel loader	19	56
Track loader	2	6
Dozer	5	15
Elevating (paddle) scraper	0	0
Standard wheel scraper	0	0
Road grader	2	6
Other	3	9

*Adds to more than 100 percent because of multiple responses.

II. Solid Waste Management Systems

1. Who performs manure collection and hauling at your feed yard? (64 feedlots responded)

	Collection		Hauling	
	No. Feedlots	Percent of Feedlots*	No. Feedlots	Percent of Feedlots
Feedlot Personnel and Equipment	29	45	11	17
Contractor Personnel and Equipment	42	66	52	81
Other: Farmers	0	0	1	2

*Adds to more than 100% because of multiple responses.

2. How often is manure collected from each feedpen?

Time Interval	No. Feedlots	Percent
4-6 months (or after every pen shipped)	9	15
6-12 months (or after every 2 pens shipped)	17	29
Annually	23	39
1-3 years	10	17
	59	100

3. What types of machinery are regularly used in manure collection and loading? (65 feedlots responded)

   a. Individual machines in use:

	No. Feedlots	Percent of Feedlots*	No. Machines
Wheel loader	62	98	93
Elevating scraper	2	3	4
Chisel plow	10	16	10
Rototiller	0	0	0
Disk plow	0	0	0
Farm Tractor	10	16	12
Box Scraper	2	3	8
Road grader	2	3	2
Track loader	1	2	1
Dozer	6	10	7
			135

*Adds to more than 100 percent because of multiple responses.

b. Equipment combinations utilized for manure collection and loading:

Equipment Combinations	No. Feedlots	Percent
Wheel loader only	44	70
Wheel loader, chisel plow, and tractor	9	14
Wheel loader, chisel plow, tractor, and dozer	1	2
Wheel loader, box scraper, and tractor	2	3
Dozer and wheel loader	3	5
Elevating scraper, wheel loader, and track loader	1	2
Elevating scraper, wheel loader, and dozer	1	2
Road grader and wheel loader	1	2
	63	100

c. Estimated energy requirements for manure collection, loading, and hauling:

Phase of Manure Handling	Annual Energy Consumption Per Feedlot hp-hrs/year		Annual Energy Consumption per Head Capacity hp-hrs/head/year	
	Average	Range	Average	Range
Collection[1]	78,200	8,400 - 316,000	3.2	2.1 - 3.5
Loading[2]	39,300	3,800 - 142,000	1.6	---
Hauling[3]	597,000	58,300 - 2,190,000	24.6	---
Total	714,000		29.4	

Assumptions:

[1]Manure tonnage is 1.8 tons/year/head capacity; energy for collection is 1.95, 1.46, 1.19, and 1.75 hp-hrs per ton for wheel loader, wheel loader plus chisel plow, elevating scraper, and tractor/box scraper systems, respectively, at field operating efficiency.

[2]Energy requirement for loading manure into trucks with wheel loader is 0.88 hp-hrs per ton.

[3]For 5 mile haul distance (one-way) energy for manure hauling is 13.5 hp-hrs per ton at 3.5 miles per gallon and 10.3 ton per load.

4. What was the maximum amount of manure stockpiled at your feedlot in 1978? (58 feedlots responded)

   a. Number feedlots with manure stockpile = 34 (59 percent)

   b. Number feedlots without manure stockpile = 24 (41 percent)

   c. Of those feedlots that stockpiled manure in 1978:

		Average	Range
1.	Feedlot size, head	23,400	2400 - 90,000
2.	Amount of manure stockpiled, tons	11,600	50 - 30,000
	tons/hd	0.82	0.01 - 4.0
3.	Estimated backlog of manure production, years	0.46	0 - 2.2

5. What is the current price of manure from your feedlot? (51 responses)

   a. Net Revenue to feedlot: Average = $0.43 per ton
   Median = $0.00
   Range = -$0.50 to +$3 per ton

   b. Cost to farmers: (43 responses)

Manure Cost Formulas		Total Cost per ton for Haul Distance of: 5 mi.	10 mi.	15 mi.
Average:	$1.58 per ton + $0.16 ton-mile	$ 2.38	$ 3.18	$ 3.98
Highest	$4.00 per ton + 0.50 per ton-mile	6.50	9.00	11.50
	$2.00 per ton + 1.00 per ton-mile	7.00	12.00	17.00
	$0.00 per ton + 1.50 per ton-mile	7.50	15.00	22.50
Lowest	$0.00 per ton + 0.00 per ton-mile	0	0	0

6. How would you rate the relative importance of the following factors in feed yard manure collection and handling?

		Rating Scale Low 1	2	Med. 3	4	High 5	Total Percent	Weighted Average Score
a.	Frequent manure collection (57 feedlots)	7%	7%	30%	21%	35%	100	3.7
b.	Operator training (57)	0	5	32	30	33	100	3.9
c.	Machinery selection (59)	2	7	32	27	32	100	3.8
d.	Equipment maintenance (55)	2	5	9	29	55	100	4.3**
e.	Pen size and shape (60)	5	12	23	27	32	99	3.6
f.	Width of alleys (57)	5	5	21	32	37	100	3.9
g.	Leaving smooth pen surface (60)	0	7	8	30	55	100	4.3**
h.	Leaving undisturbed manure pack over soil (60)	8	10	17	35	30	100	3.7
i.	Mounding inside feedpens (58)	14	26	21	19	21	101	3.1*

*Lowest/least important
**Highest/most important

III. Land Disposal

1. How much land, owned by the feed yard, is available for manure disposal? (65 feedlots)

	Average	Median	Range
Manure disposal area, acres	842	240	0 - 5000
Acres per 1000 head capacity	85	7.3	0 - 1100

2. At what rate is manure applied to this land? (49 feedlots)

	Application Rate, tons/acre/year
Average	14
Median	10
Range	0 - 50

3. How much manure is sold to area farmers? (56 feedlots)

	Manure Sold to Farmers	
	Tons Per Year	Tons/hd capacity/yr
Average	15,694	0.66
Median	6,000	0.40
Range	0 - 120,000	0 - 2.5

4. What crops are fertilized with manure from your feedlot and what application rate is used?

		Manure Application Rates, tons/acre/yr	
Crop	No. Feedlots Responding	Average	Range
Grain Sorghum	32	12	5 - 40
Corn	39	12	10 - 30
Wheat	34	11	10 - 20
Oats	1	11	-
Alfalfa	5	13	10 - 20
Cotton	11	12	10 - 30
Potatoes	2	21	10 - 30
Other: Improved Pasture (Sudan, Coastal Bermuda-grass)	5	24	12 - 35
Citrus	1	15	-

5. How important are the following factors in selling feed yard manure to farmers?

	Rating Scale Low 1	2	Med. 3	4	High 5	Total Percent	Weighted Average Score
Cost of manure (57 feedlots)	5%	2%	9%	14%	70%	100	4.4
Physical properties for spreading (58)	9	12	17	40	22	100	3.5
Nutrient content (57)	9	14	33	30	14	100	3.3
Salt content (57)	21	16	28	18	18	101	2.9*
Weed seed potential (54)	13	20	20	30	17	100	3.2
Distance to cropland (57)	4	2	11	14	70	101	4.5**
Availability of irrigation water (54)	17	6	15	24	39	101	3.6
Season/cropping cycles (55)	7	9	25	27	31	99	3.7

*Lowest/least important factor.
**Highest/most important factor.

IV. Dust, Odor, and Fly Control

1. How often is dust from feed pens a significant problem at your feed yard?

Time Interval	No. Feedlots	Percent
Annually	35	54
2 - 5 years	10	15
5 - 10 years	3	5
Never	17	26
	65	100

2. What methods and equipment are used for dust control?

   a. Roads (59 feedlots responded)

	No. Feedlots	Percent of 59 Feedlots*
Paving	15	25
Oil Application	2	3
Water trucks	15	25
Water tanker	6	10
Other: Gravel	6	10
None	22	37

b. Feed pens (56 feedlots responded)

	No. Feedlots	Percent of 56 Feedlots*
Mobile water tanker	4	7
Water trucks	5	9
Solid set sprinklers	1	2
Increased stocking rate	15	27
Other: Pen shaping or cleaning	3	5
None	32	57

*Column adds to more than 100 percent because of multiple responses to questions.

3. Indicate which odor control methods are used and their relative effectiveness:

Odor Control Method	No. Feedlots That Use	No. Feedlots That Rated Effectiveness	Effectiveness Low 1	2	3	4	High 5	Total %	Weighted Average Score
			% of Responses						
Frequent manure collection	33	32	6	0	34	40	19	99	3.7
Collecting surface manure layer only	14	14	7	14	36	29	14	100	2.7
Good drainage of feed pens	44	43	2	0	19	21	58	99	4.3**
Watering system maintenance	13	15	7	0	7	40	47	101	4.2
Apply chemical/biochemical products to feedlot surface	1	2	100	0	0	0	0	100	1.0*
Odor masking chemicals	3	4	75	0	25	0	0	100	1.5
Rapid pump down of runoff holding ponds	25	25	0	4	24	24	48	100	4.2
Chemical/biochemical treatment of holding ponds	8	9	0	44	22	33	0	99	2.9

4. Which of the following fly control methods are used and how effective are they?

Fly Control Method	No. Feedlots That Use	No. Feedlots That Rated Effectiveness	Effectiveness Low 1	2	3	4	High 5	Total %	Weighted Average Score
			% of Responses						
Clean vacant pens	39	37	3	14	32	27	24	100	3.6*
Clean horse pens and sick pens	36	35	0	3	43	34	20	100	3.7
Clean along fence lines	35	38	0	5	29	32	34	100	3.9
Clean shipping and receiving pens	33	31	0	6	48	26	19	99	3.6*
Clean along feed bunks	42	39	0	3	41	28	28	100	3.8
Correct pen drainage problems	39	38	0	3	18	42	37	100	4.1**
Repair leaky water lines/ troughs	41	39	0	3	26	28	44	101	4.1**
Pesticide fogging or spraying along feed bunks	47	47	0	6	32	32	30	100	3.9
Pesticide spraying around feedmills	43	42	0	7	40	29	24	100	3.7
Pesticide treatment of manure storage areas	9	10	0	10	40	20	30	100	3.7
Pesticide treatment of wet spots in feedpens	18	19	5	5	21	26	42	99	3.9
Pesticide treatment of settling basins or channels	10	11	0	0	45	18	36	99	3.9
Pesticide treatment of holding ponds	9	9	0	11	33	33	22	99	3.7

*Lowest/least effective
**Highest/most effective

5. How often are the following types of equipment used in chemical treatment for fly control during the fly season?

a. Number of feedlots using equipment: (64 feedlots)

Type of Equipment	No. Feedlots	Percent of Feedlots*
Ground foggers	31	48
Ground sprayers	33	52
Hand sprayers	5	8
Aerial application	9	14
Fly bait	50	78
Other:		
Predatory insects	1	2
Feedgrade larvicide	1	2
Drug in feed	1	2

*Adds to more than 100 percent because of multiple responses.

b. Frequency of use of fly control practices:

Type of Equipment	Daily	3 Times per Week	2 Times per Week	Weekly	Every 2 Weeks	Monthly	Every 2 Months	Annually	Continuously	As Needed/ Occasionally
	Number of Feed Yards									
Ground Foggers	5	4	9	6	0	0	1	0	0	2
Ground Sprayers	2	1	15	7	4	0	0	0	0	2
Hand Sprayers	1	1	1	0	0	0	0	0	0	2
Aerial Application	0	0	0	2	0	0	2	4	0	1
Fly Bait	6	5	6	18	2	1	0	0	5	2
Other:										
Predatory Insects	0	0	0	0	0	1	0	0	0	0
Feedgrade Larvacide	1	0	0	0	0	0	0	0	0	0
Totals	15	11	31	33	6	2	3	4	5	9

V. Manure Processing and Utilization

1. In your opinion, would the following potential methods of manure processing or utilization be beneficial to your feeding operation?

Method	Benefits Low 1	2	3	4	High 5	Total %	Weighted Average Score
Feeding cattle manure in ration (55 feedlots)	53%	22%	16%	2%	7%	100	1.9
Feeding poultry manure in ration (52)	58	17	17	2	5	99	1.8
Fuel gas production (56)	16	9	18	14	43	100	3.6**
Composting (47)	40	19	15	11	15	100	2.4
Ensiling (49)	57	20	16	2	5	99	1.8
Chemical preservatives (47)	66	26	9	0	0	101	1.4*

*Lowest/least beneficial
**Highest/most beneficial

2. What are the major obstacles to feeding animal manure in a feed yard ration?

Factor	Size of Problem Low 1	2	3	4	High 5	Total %	Weighted Average Score
Nutrient content and digestibility (50 feedlots)	6	6	30	28	30	100	3.7
Variability in composition (50)	6	8	18	32	36	100	3.8
Processing/handling cost (51)	0	8	8	25	59	100	4.4**
Mechanical systems (milling, etc.) (51)	2	6	24	12	57	101	4.2
Residue potential (51)	20	12	20	18	31	101	3.3*
Disease potential (52)	19	12	21	21	27	100	3.3*
Regulatory constraints (52)	12	8	14	29	37	100	3.7
Consumer acceptance (54)	15	9	20	11	44	99	3.6
Feeder-customer acceptance (50)	16	18	14	10	42	100	3.4

*Lowest/least problem
**Highest/most problem

3. Do you feel the potential benefits (to cattle feeders) of feeding manure outweigh any problems? (53 feedlots responded)

	No. Feedlots	Percent
Yes	15	28%
No	38	72%
	53	100%

VI. Water Supply System

1. What type of cattle drinking water system do you have? (62 feedlots)

	No. Feedlots	Percent of Feedlots*
Continuous overflow system	27	44
Float System	45	73

Pumping rate for continuous overflow systems:

Average = 2.8 gpm/trough

High = 10 gpm/trough

Low = 0.25 gpm/trough

2. Are water troughs heated or unheated? (62 feedlots)

	No. Feedlots	Percent of Feedlots*
Heated	20	31
Unheated	45	73

Type of Water Trough Heaters	No. Feedlots
Electric	13
Gas	3
Both	1

*Adds to more than 100 percent because of multiple responses.

3. How often are water troughs cleaned? (61 feedlots)

	No. Feedlots	Percent of Feedlots
Daily	6	10
Three-five times/week	2	3
Twice weekly	20	33
Once or twice weekly	6	10
Weekly	25	41
Every one-two weeks	1	2
Every six months	1	2
	61	101

4. What is the number and size of drinking water storage tanks# at the feed yard? (46 feed yards responded)

	Average	Range
No. storage tanks	2.0	0 - 10
Total water storage volume, gallons	59,040	0 - 564,000
gallon/hd	4.1	0 - 17.7
Capacity of individual tanks, gal	56,700	850 - 282,000

#Excludes water troughs and earthen storage tanks.

5. Are storage tanks heated?

	No. Feedlots	Percent
Yes	0	0
No	53	100

6. Water Source:

	No. Feedlots	Percent
Surface	2	3
Groundwater	56	92
Other: Irrigation canal	1	2
City	2	3
	61	100

7. In your well, what is the depth to groundwater (55 feedlots responded)

Average Depth = 318 ft

Deepest well = 1500 ft

Shallowest well = 65 ft

VII. Feed Distribution System

1. How many times per day are cattle fed?

	No. Feedlots	Percent
Once per day	4	6
Twice per day	42	68
Three times per day	12	19
Four times per day	4	6
	62	99

2. How often are feed bunks normally cleaned?

	No. Feedlots	Percent
Daily	2	3
Three-four times per week	4	6
Two times per week	10	16
Weekly	24	39
Every two weeks	2	3
Monthly	1	2
As needed	17	27
Never	2	3
	62	99

3. What type of equipment is used for bunk cleaning? (62 feedlots)

	No. Feedlots	Percent*
Rotary brush	34	55
Manual labor	50	81
Other	2	3

*Adds to more than 100 percent because of multiple responses.

4. Are batter boards placed in troughs between pens to prevent migration of medicated feeds?

	No. Feedlots	Percent
Yes	5	8
No	57	92
	62	100

5. What types of feed trucks are regularly used for feed distribution? (65)

	Average	Median	Range
No. feed trucks per feed yard	3.3	3.0	1 - 10
No. feed trucks per 10,000 hd	2.1	1.4	0.4 - 14.3

Type of Fuel	No. Feedlots	Percent*	No. Trucks
Gasoline	55	85	157
Diesel	21	32	47
Other: Propane, Butane	2	3	3

*Adds to more than 100 percent because of multiple responses.

VIII. Feed Processing System

1. Do you utilize acid treatment of high moisture grain?

	No. Feedlots	Percent
Yes	13	20
No	51	80
	64	100

2. Is grain steam flaked?

	No. Feedlots	Percent
Yes	46	71
No	19	29
	65	100

3. What is the average energy consumption for grain processing?

a. Energy consumption per head:

STEAM FLAKING[1]

Fuel	No. Feedlots	Ave. Feedlot Capacity hd.	Monthly Fuel Consumption	Monthly Energy Use Per Head BTU/hd/mo
Natural gas, mcf	28	30,660	2,575	83,980
Electricity, kw-hr	25	30,460	152,426	17,090
			Total	101,070

DRY HEAT

Fuel	No. Feedlots	Ave. Feedlot Capacity hd.	Monthly Fuel Consumption	Monthly Energy Use Per Head BTU/hd/mo
Natural gas, mcf	4	19,500	1,832	93,235
Electricity, kw-hr	3	13,470	48,260	12,235
			Total	106,185

b. Energy prices paid by feed yards:

	No. Feed Yards	Avg. Price	Price Range
Natural gas, $/mcf	35	$1.62	$0.92 - $2.85
Electricity, $kw-hr	30	$0.037	$0.017 - $0.060
LPG (propane), $/gallon	3	$0.32	$0.28 - $.34

[1]Two additional feedlots (30,000 head ave.) used LP gas in lieu of natural gas, consuming 11,570 gal/mo, or 35,535 BTU/hd/mo.