The Controlled Environment Feedlot

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Cattle feeding plays an important role in the agricultural economy of many states in the United States. In Iowa alone, cattle feeders received approximately $1.56 billion of gross receipts. This generation of income also supports many jobs in the input supply and product processing sectors. It is estimated that every dollar of livestock sales generates $2.25 for those companies and industries that serve the livestock industry.

Recent developments in the economy of cattle feeding has resulted in severe financial losses for the feeder and now for the cow-calf producer. This appears to be short run in that cattle feeding will be more profitable in the long run. Further, with innovations such as recycling manure, and efforts to combat stress in open feedlots, as well as means to economize on labor, the controlled investment in cattle feeding is being considered by many cattlemen. This is particularly true in the Midwest where adverse weather adds stress to the cattle, affecting feeding efficiency.

There are many alternatives to confinement feeding. Location of the building, type of facility, cost figures applied, number of cattle, weather condition, capital, degree of management and potential advantages must all be considered for the facility.

A confinement system is defined as any system when the movement of cattle is restricted under a roof and the two systems now used are warm or closed confinement or cold or open confinement. The warm system consists of a building enclosed on all sides, insulated, fan ventilated and has some system of controlling inside air temperature. Manure handling systems usually are restricted to some form of liquid pit system. The cold confinement allows more variation, does have a roof, but usually has a system of allowing air within the building to fluctuate with outside temperature because of open front or other means of allowing outside air to circulate. Manure handling systems include slotted floor, deep pit and irrigation; deep pit and field spread; flush gutter system and solid floor with manure scrape.

The traditional open lot with windbreak fence is usually used by the small feeder. The majority of the cattle fed in the Midwest are fed in this type of system. In most cases, the lot, the bunks, the shed or old barn already are there and have been depreciated or are useless for other purposes. However, to set up a system from scratch, the investment involved must be considered. The following is the initial cost for 100 head capacity. An analysis for larger units can be determined by multiples of the 100 head unit. This type of investment is given for comparisons with confinement type systems.

Table 1

Comparison of Investments**

Item	Open Lot Shelter* Total	Open Lot Shelter* Per Head	Open Lot Windbreak* Total	Open Lot Windbreak* Per Head
Windbreak Fence 8x45'	$ 138	1.38	$ 552	5.52
Pole Bldg. 20 sq. ft./head plus grading $55	4,055	40.55	---	---
Concrete 58 cu. yds.	1,827	18.27	1,827	18.27
Precost bunks 150' x 7.50	1,125	11.25	1,125	11.25
Road along bank - 60 yds. gravel	280	2.80	280	2.80
Cable fence (no labor)	505	5.05	505	5.05
Dirt mound 500 cu. yds.	375	3.75	375	3.75
Water - pipe - trenching	275	2.75	215	2.75
Wiring waterer and lights	160	1.60	160	1.60
Grading 462 cu. yd.	231	2.31	231	2.31
Land 1.2 acres at $800	960	9.60	960	9.60
Total	9,931	99.31	6,230	62.90

*Based on 1974 costs. **From Evaluation of Feedlot Systems - PM602 by Michael D. Boehlje and Larry D. Trede, Ag Economics, ISU.

Cold confinement with slats, deep pit and irrigation:

The building with a drive-through feeding alley has several pens with each pen allowing 16 sq. feet per animal. The concrete slats cover the floor with an eight-foot pit under the floor surface where it can be pumped and irrigated. Table 2 depicts cost estimates for cold confinement with deep pit for 300 head.

Cold confinement - flush gutter system:

This system has a floor sloped to a flushing flume. Only the flume is covered with slats, cattle work manure into flume and liquids from lagoons are used to periodically flush flume.

The investment for a 300-head capacity cold confinement unit with a flush gutter is shown in Table 3.

Cold Confinement - Manure Scrape:

This is an uninsulated building with a solid concrete floor. A feed bunk runs through the building with eight inches of bunk per head. Bedding is added and periodically the floor is scraped and manure

Table 2

	Investment Total	Per Head
Land - 0.25 acre at $800	$ 200	.66
Building 40 x 200' with pit 200 x 24' x 8'	1,600	53.33
Duct excavation and hauling	1,200	4.00
200 sq. yd. concrete	4,200	14.00
Steel	700	2.33
Farming materials	1,200	4.00
Labor	8,400	28.00
Concrete approach	168	.56
Slatted floor	6,000	20.00
Waterers 3 at $150 each	450	1.50
Pipe and labor	250	.83
Electricity	300	1.00
Gates - fencing 25 at $40	1,000	3.33
Bunks - 200 ft. at $8.50/ft.	1,700	5.67
Totals	27,368	139.21

Table 3

	Investment Total	Per Head
Land - 0.25 acre at $800	$ 200	0.66
Building 40' x 200'	16,000	53.33
Concrete approach	168	0.56
Concrete floor 24' x 200'	4,800	16.00
Flushing flumes 400' x at 5.75	2,300	7.67
Bunks 200 at 8.50	1,700	5.67
Gates 25 at 40.00	1,000	3.33
Waterers 3 at 150.00	450	1.50
Water pipe and labor	250	0.83
Electricity	300	1.00
Grading	155	0.52
Sub Total	27,323	91.07
Lagoon - 300 Cattle 75' x 200' x 16'		
4000 cu. yd. dirt	4,000	13.33
Pipe and trench	400	1.33
Pump and electricity	800	2.67
Land - 0.61 acre at $800	490	1.63
Sub Total	5,690	18.96
Total	33,283	110.03

hauled to the field. Investment for 300-head cold confinement solid floor manure scrape is charted below.

Table 4

	Investment Total	Per Head
Land .25 acres at $800	200	.66
Building 40' x 200'	16,000	53.33
Concrete approach - vehicles	168	.56
Concrete floor 24' x 400'	4,800	16.00
Bunks 200' at $8.50	1,700	5.67
Gates 25 at $40	1,000	3.33
Waterers 3 at $150	450	1.50
Water pipe and labor	250	.83
Electricity	300	1.00
Grading	155	.52
Total	25,023	83.40

For feedlots of 300 capacity or less existing water supply is expected to be adequate. Scales, and office space is not included.

Table 5

Space Requirements and Animal Performance for Various Beef Feedlot Systems

	Calves		Yearlings		
	Open Lot Wind-	Open Lot Shel-	Open Lot Wind-	Open Lot Shel-	Com-ponent
Space requirements per head					
Lot	250	250	250	250	---
Shelter		20		20	16
Animal Performance lbs. gain/day					
In Lot	210	2.30	2.50	2.70	2.70
Pay weight	195	2.14	2.25	2.42	2.42
Death loss	2%	2%	1%	1%	1%
Medical Costs/head	$7.30	$7.30	$4.30	$4.30	$4.30
Feedlot gain per space per year (lbs.)	710	7.74	845	890	890
Payweight gain per space per yr. (lbs.)	660	726	760	800	800
Turnover rate	1.1	1.2	1.9	2.0	2.0

Calves without shelter require approximately 10% more feed per pound of gain. Yearlings with shelter require 10% more feed per pound of gain than calves with shelter and yearlings without shelter require 10% more feed per pound of gain than yearlings with shelter.

Summary

1. Confinement systems are competitive with open lots, particularly in size categories of 300-head or more. Confinement systems require more investment capital than open lots, but they can operate with less labor.
2. Confinement systems provide more control over the environment, providing greater rate of gain and feed efficiency. Feed efficiency alone in some cases would pay for the building in a ten year period.
3. Confinement systems meet EPA regulations with less difficulty.
4. Limited studies indicate less disease problems in confinement.
5. The type of confinement system to be recommended depends upon the method of capital outlay, number of cattle to be fed, manure to be recycled and waste disposal schemes.

Personal Observations of Confinement Units

1. Normally yearlings are fed in confinement units, thus less disease problems are observed than what is seen with calves.

2. Most cattle are backgrounded prior to going into confinement units, thus the major respiratory infections are over prior to their entry into confinement.
3. Direct observation of animals is difficult because of the limited space allowed for them (16 to 20 sq. ft.). Thus, many sick animals are missed for a period of time. Catwalks or more time with the cattle would alleviate this problem.
4. When a disease outbreak does occur, ringworm, respiratory diseases, warts and lice spread readily from animal to animal because of their close proximity.
5. Recovery of sick animals is more rapid in confinement than in an open lot because of reduced chill factor.
6. Leg trouble is frequently observed and a majority of this is from animals stepping on one another resulting in contusions and in some cases leading to a generalized septicemia and arthritis. The same injuries are observed on the tails of animals.

Processing Manure and its Utilization

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Feeding feces is by no means a new concept, even though it has only recently received publicity due to public concern as it fits in the overall picture of environment pollution abatement. Early in the 1940's cow manure was looked upon as a source of B-complex vitamins. Hammond (1942) reported on studies in which cow manure was used as a source of certain vitamins for growing chickens and later (Hammond, 1944) where cow manure or dried rumen contents was substituted for alfalfa meal in poultry diets. Bohstedt, Grummer, and Ross (1943) used cattle manure as a carrier of B-vitamins in rations for pigs. Lillie, Denton, and Rind (1948) demonstrated that cow manure contained a growth factor giving essentially the same gain response in chicks as crystalline B_{12}.

Anthony and Nix (1962) reported a study for which one of the objectives was to develop an effective means of disposing of organic residues voided by confined cattle through refeeding. This early study involved the feeding of washed wet fecal residues. Excellent gains (3 lbs./day) were obtained for the three yearling fattening steers in the trial with 40% of the feed coming from washed fecal residue. No outward symptoms of harm nor difficulties in consumption were observed. Additional trials with wet fecal residue were conducted at Auburn University (Anthony, 1966) where gains of 3.60 lbs./day were obtained with Holstein bulls.

This practice was abandoned (Anthony, 1966) in favor of whole feedlot feces recycling. Combining feedlot feces with concentrates (40:60 ratio) was not a satisfactory practice based on animal weight gain and carcass grade. Blending fresh manure with high energy feeds lowered performance and digestion coefficients. It was theorized that manure contained a growth depressing factor since no intake and palatability problems were encountered. However, washing and heat treatment rendered feedlot cattle manure a useful feed for cattle by lowering the basal feed dry matter required per unit gain.

A later approach was to combine feedlot manure (57 parts) and ground bermudagrass hay (43 parts) for making a high dry matter silage (Anthony, 1966, 1967, 1968, and 1969). Manure from all-concentrates had no nutritional advantage over manure from animals fed haylage for making the high dry matter manure silage. Dry matter, crude protein, and cellulose digestion coefficients were essentially the same for the two manure sources as measured with steers. The manure-Bermuda haylage also maintained ewes in better physical condition with less total dry matter than when only Bermudagrass hay was fed.

Anthony (1967, 1968) developed the "Wastelage Concept" for effectively using feedlot manure as a feed. His reports (1967, 1968, and 1969) indicate success based on the equal or nearly equal daily gains, lower parakeratosis, and equal carcass grades (choice). Wastelage was also used successfully for ewes and beef cattle kept for reproduction. Low birth weights of lambs were improved by vitamin A injections. Cattle performed as well on wastelage as they did on corn silage. However, both groups were supplemented with a protein-mineral-vitamin A mix.

Only one-half of the daily manure excreted could be reused in grain: manure rations (Anthony, 1970). Little difference was found in nutrient value between cooked and washed manure. High grain rations containing wet manure were consumed well. These rations supported gains similar to cattle fed feeds without manure, although the total daily dry matter