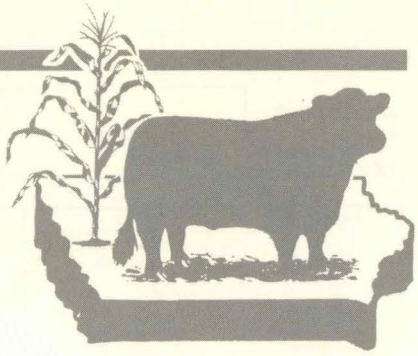
Beef Cattle Feeding In Iowa 1974



EVALUATION OF FEEDLOT SYSTEMS

Cattle feeding plays an important role in the agricultural economy of Iowa. Iowa cattle feeders received approximately $1.56 billion of gross receipts from fed cattle marketings in 1973. This generation of income also supports many jobs in the input supply and product processing sectors. Studies show that each dollar of livestock sales generates an additional $2.25 of revenue for feed and pharmaceutical companies, equipment manufacturers, packing and processing plants, etc.

Fed cattle marketings in Iowa totaled 3,389,000 head in 1973. Marketings dropped by 617,000 head from 1972 to 1973, but the 1973 total still represents a 7 percent increase in marketings over the 1962-65 period. In 1973, Iowa cattle feeders marketed about 12.8 percent of the fed cattle in the United States compared with 14.4 percent in the previous year.

Although recent developments including substantial losses in cattle feeding raise serious concerns about the short-run future of the industry, most analysts agree that cattle feeding will be profitable over the long run. As prices adjust to more profitable levels, interest in updating, modification, and expansion of cattle feeding facilities is likely to increase.

CATTLE FEEDING SYSTEMS

Cattle feeding systems used by Iowa farmers are varied, since many systems are an outgrowth of changes in technology. In the following discussion, the more widely used cattle feeding systems in Iowa are analyzed. Eight different systems are described by type of facility used, feeding program, and type of cattle. Within each system, six different size groups are analyzed. Other systems could be identified, but these eight alternatives provide a summary of the wide range of cattle feeding systems that are currently found in the state.

Feeding Facilities

Open lot with windbreak fence: In this system, cattle are fed in an open lot with no shelter. However, an 8-foot-high windbreak fence on one end and part of one side of the lot provides some protection against adverse weather. The open lot allows 250 square feet of space per animal. Mounds provide a sleeping and resting area for the cattle. The lot is surrounded by a five-strand cable fence, and a gravel road lies along the perimeter of the lot where the feedbunk is located. Feeding is done in a fenceline bunk placed on a concrete apron with 1.5 feet of feeding space per head capacity. A diversion terrace located on the upper side of the feedlot directs runoff away from the lot. Rainfall and snow runoff from the lot surface and animal wastes are diverted to a settling basin where the solid material is hauled away and the liquid material flows into a retention facility. An irrigation system is used to remove excess liquid from the retention pond.

Figure 1 illustrates the open lot with windbreak fence (or shelter) for a 100-head-capacity unit. The total investment and investment per head for the open

Prepared by Michael D. Boehlje, associate professor of economics, and Larry D. Trede, instructor of economics.

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IOWA STATE UNIVERSITY
Ames, Iowa 50010

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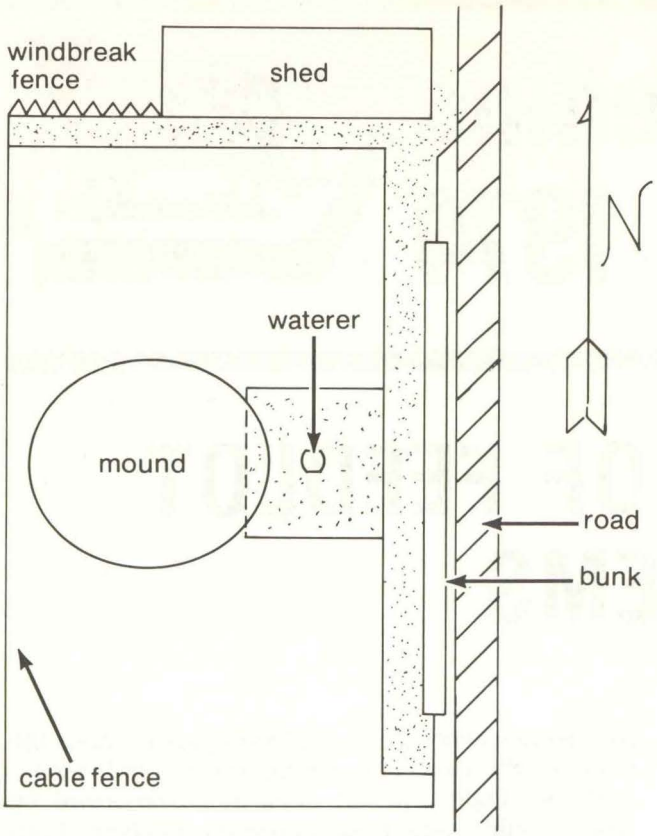
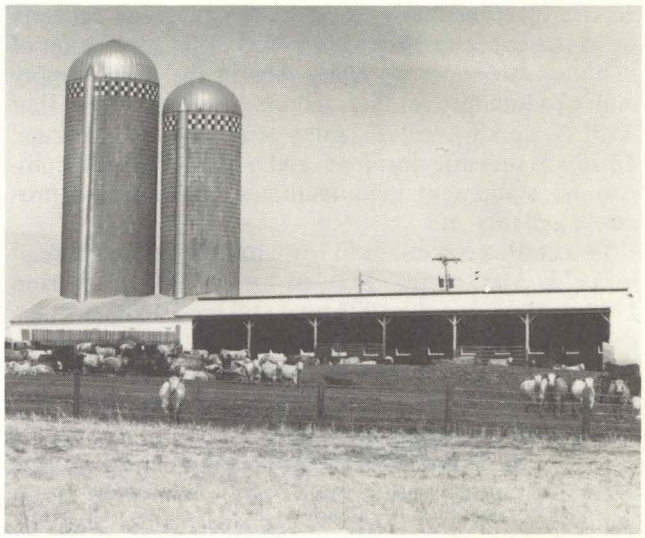


Fig. 1. Diagram for open lot with shelter or windbreak fence.

lot and its component parts are given in table 1. The investment analysis is for a 100-head feedlot, and values for larger units can be determined as multiples of the 100-head unit.

Open lot with shelter: This system is similar to the open lot with windbreak fence except that shelter is provided. The shelter is a pole-type, uninsulated building and has a dirt floor. It is enclosed on three sides with the fourth side containing doors that are partly closable. Twenty square feet of shelter space is provided per head capacity. A concrete apron runs alongside the building, joining it with the feedbunk. Thirty square feet of mound space per head capacity is provided as a resting area for the cattle. The lot is surrounded with a cable fence, and there is also a windbreak fence along the north side next to the building. Waterers, barn lights, and night lights are included, and animal wastes are handled in the same way as in the open lot with windbreak. Figure 1 illustrates this feedlot, and investment data are shown in table 1.

Cold confinement with slats—deep pit and irrigation: Cattle fed in this facility are confined inside an uninsulated building with a drive-through feeding alley. The building is divided into several pens, each allowing 16 square feet per animal space. A fenceline bunk runs lengthwise through the building and allows 8 inches of bunk space per animal. The floor is totally slatted with concrete slats, and the building includes an 8-foot-deep pit under the entire floor surface area. A concrete approach is included on each end of the building to allow for easy movement of vehicles. Animal waste is pumped directly from the pit and irrigated using a high-capacity irrigation pump and equipment. Figure 2 illustrates this building, and table 2 summarizes the investment capital for the building and its component parts. The investment data are for a 300-head unit. Values for larger units can be obtained as multiples of the 300-head unit.



In this feedlot, cattle can find shelter in the open-front building. Good drainage away from the building helps keep slopes dry and suitable for cattle during favorable weather.

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Table 1. Investment for a 100-head-capacity open lot with shelter or windbreak fence.

	Investment			
	Open lot - Shelter		Open lot - windbreak fence	
Item	Total	Per head	Total	Per head
Windbreak fence—8' high x 45'	$ 138	$ 1.38	$ 552	$ 5.52
Pole building—20 sq. ft./hd.; grading, $55	4,055	40.55	——	——
Concrete paving, 58 cu. yd. @$21 + labor	1,827	18.27	1,827	18.27
Precast concrete bunks; 150' @ $7.50	1,125	11.25	1,125	11.25
Road along bunk (60 yd. gravel)	280	2.80	280	2.80
5 strand cable fence; posts—9' spacing; gates, 12'; (no labor)	505	5.05	505	5.05
Dirt mound; 30 sq. ft. per head (500 cu. yd.)	375	3.75	375	3.75
Waterers + pipe + trenching	275	2.75	275	2.75
Electric wiring; waterers, barn lights, night lights	160	1.60	160	1.60
Grading (462 cu. yd.)	231	2.31	231	2.31
Land 1.2 acres @ $800	960	9.60	960	9.60
Total	$9,931	$99.31	$6,290	$62.90

Fig. 2. Cold confinement unit with slats and deep pit.

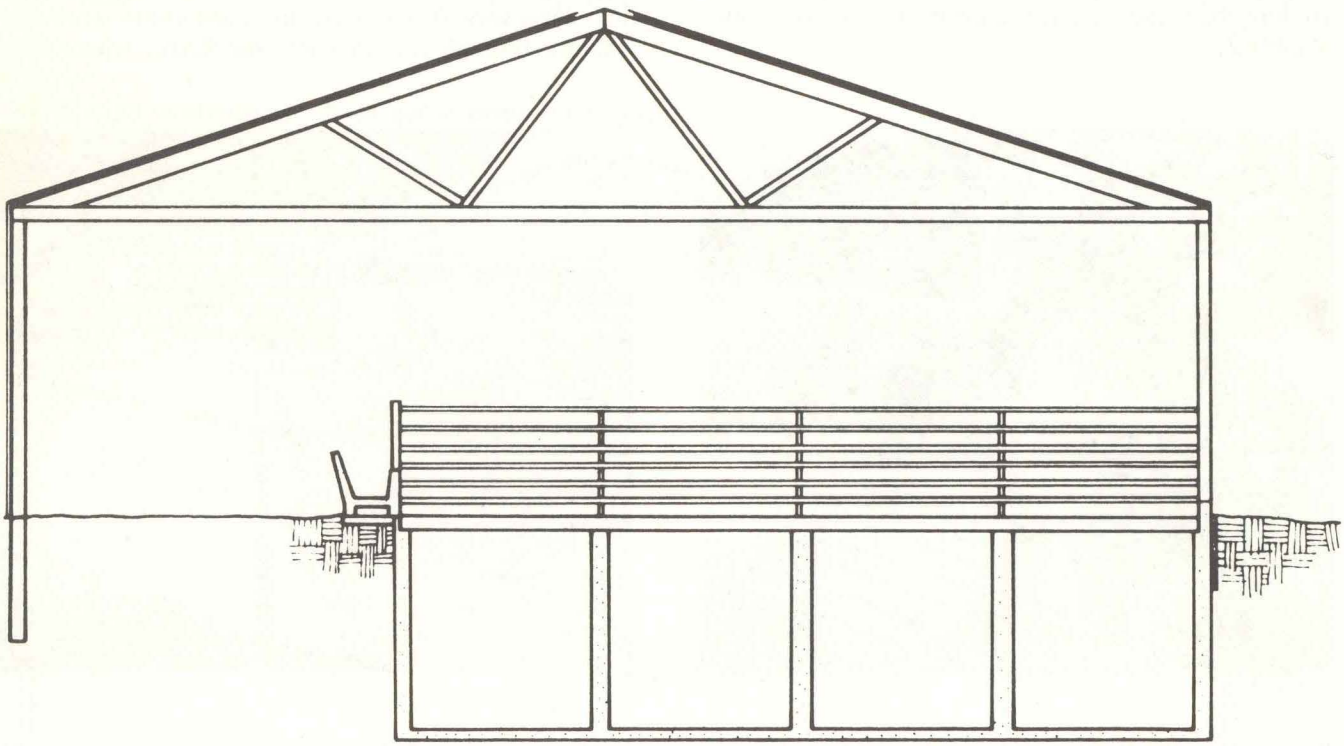
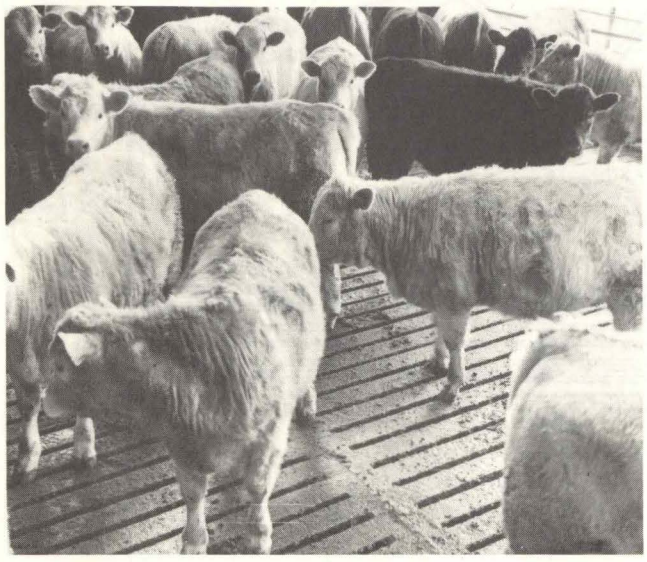


Table 2. Investment for a 300-head-capacity cold confinement unit with deep pit.

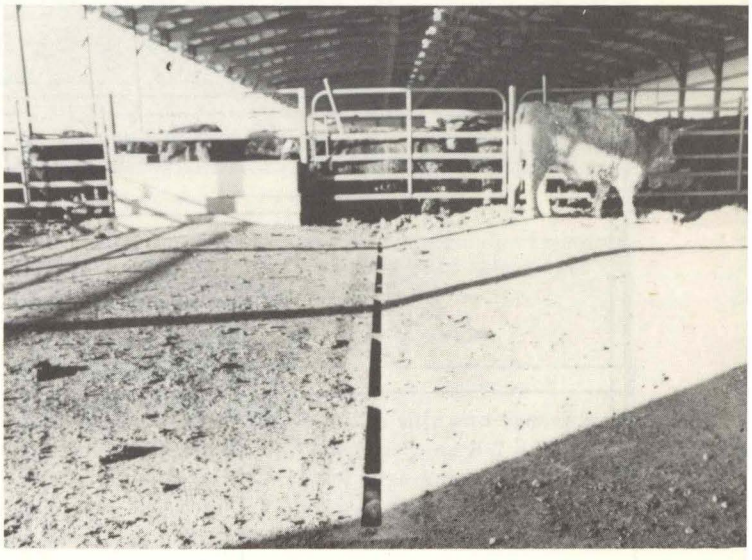
Item	Investment	
	Total	Per head
Land—0.25 acre @ $800	$ 200	$ .66
Building—40' x 200'	16,000	53.33
Pit 200' x 24' x 8'		
Dirt excavation & hauling 1,600 cu. yd.	1,200	4.00
200 cu. yd. concrete	4,200	14.00
Steel re-rod	700	2.33
Forming materials	1,200	4.00
Labor	8,400	28.00
Concrete approach for vehicles	168	.56
Slatted floor—24' x 200'—$1.25/sq. ft.	6,000	20.00
Waterers—3 @ $150 each	450	1.50
Pipe and labor	250	.83
Electricity	300	1.00
Gates, fencing—25 @ $40	1,000	3.33
Bunks, 200 ft. @ $8.50/ft.	1,700	5.67
Total	$41,763	$139.21

Cold confinement with slats—deep pit and field spread: This system differs from the cold confinement with slats—deep pit and irrigation only in the way that wastes are handled. Manure is pumped from the deep pit into a liquid manure spreader tank and then applied to cropland. The investment data for this system (excluding the waste disposal equipment) are also found in table 2.

Cold confinement—flush gutter system: The building used in this sytem is quite similar to the other confinement units. However, the floor contains a flushing unit rather than slats and a pit to handle the manure. The flushing floor is a solid concrete floor sloped to a flushing flume. A slot centered over each flume works the same way as a slatted floor; the cattle work the manure through the slats into the flume, where it is



In this slat-floored building, cattle wastes collect in a deep pit below the floor and are pumped out periodically for field spreading.



In the flush gutter confinement building, cattle work their wastes downslope to gutters running the length of the building. Gutters are flushed periodically with water to carry wastes to a lagoon.

flushed into a lagoon. Excess liquids from the lagoon are then irrigated. Figure 3 illustrates the flush gutter cold confinement system, and table 3 summarizes the investment figures for a 300-head unit. For feedlot sizes greater than 300-head capacity, multiples of these figures will give the required capital investment.

Table 3. Investment for a 300-head-capacity cold confinement unit with a flush gutter.

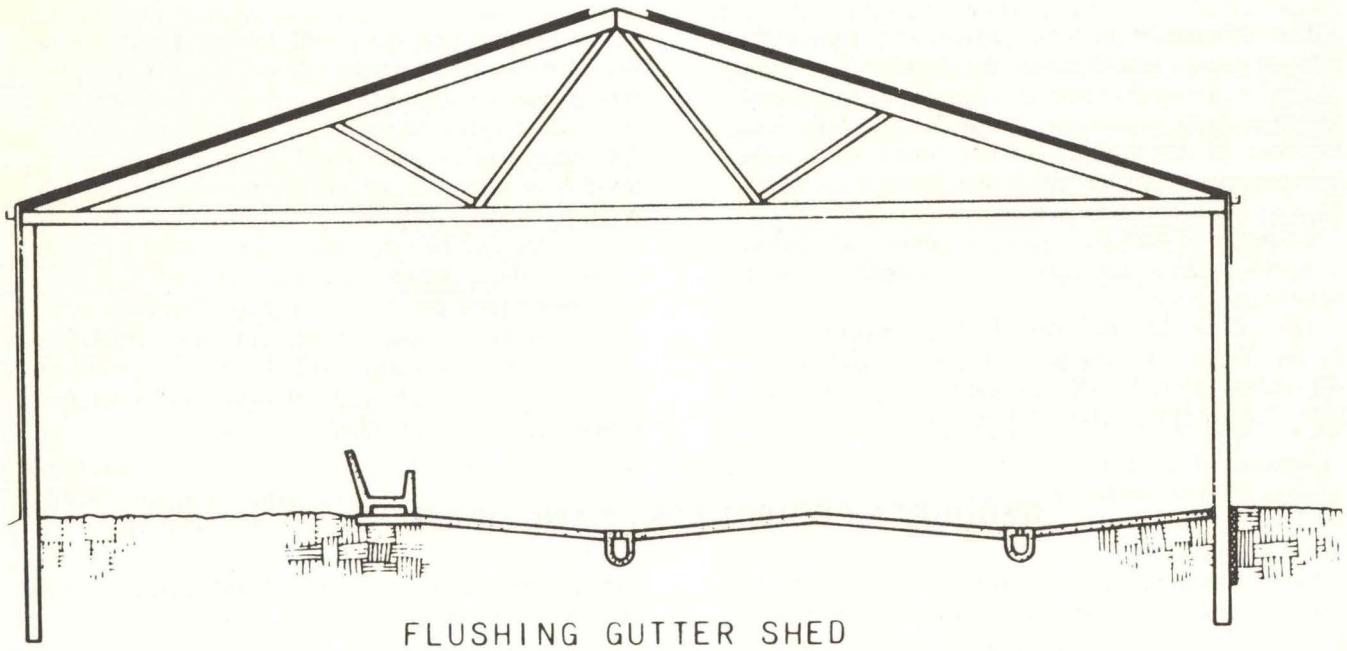
	Investment	
	Total	**Per head**
Land—0.25 acre @ $800	$ 200	$ 0.66
Building—40' x 200'	16,000	53.33
Concrete approach—vehicles	168	0.56
Concrete floor—24' x 200'	4,800	16.00
Flushing flumes 400' @ $5.75	2,300	7.67
Bunks—200 @ $8.50	1,700	5.67
Gates—25 @ $40	1,000	3.33
Waterers—3 @ $150	450	1.50
Water pipe and labor	250	0.83
Electricity	300	1.00
Grading	155	0.52
Subtotal	$27,283	$91.07
Lagoon—300 cattle 75' x 200' x 16'		
4,000 cu. yd. dirt	4,000	13.33
Pipe and trench	400	1.33
Pump and electricity	800	2.67
Land—0.61 acre @ $800	490	1.63
Subtotal	$5,690	$18.96
Total	$32,973	$110.03

Cold confinement—manure scrape: The last cold confinement building considered is the manure scrape system. The building is uninsulated with a solid concrete floor. A concrete feedbunk runs lengthwise through the building and provides 8 inches of bunk space per head. The building is equipped like the other cold confinement units. Bedding is added to the floor periodically. Solid waste material is cleaned from the building and spread on the land, using a manure spreader or spreader truck. The building design and construction are similar to that of the flush gutter system except for the floor. Table 4 gives the investment capital required for a 300-head unit.

Table 4. Investment for a 300-head-capacity solid-floor manure scrape feedlot system.

	Investment	
Item	**Total**	**Per head**
Land .25 acre @ $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' @ $8.50	1,700	5.67
Gates—25 @ $40	1,000	3.33
Waterers — 3 @ $150	450	1.50
Water pipe and labor	250	.83
Electricity	300	1.00
Grading	155	.52
Total	$25,023	$83.40

Fig. 3. Cold confinement - flush gutter cattle feeding unit.



For feedlots of 300-head capacity and less, existing water supplies and equipment may be adequate. For feedlot sizes above that level, allowances are made for new or additional wells and water systems. Scales for weighing feed and/or cattle are provided for all feedlots of 600 head and larger. No office space is provided for feedlots of 1,000-head capacity or less because record-keeping for the cattle feeding enterprise is probably integrated with other record-keeping functions of the farm business. However, for feedlots above 1,000-head capacity, an allowance is made for office space and equipment.

Feeding Program and Type of Cattle

Table 5 summarizes the animal performance and space requirements for the different systems. Calves are fed only in open lots, whereas yearlings are fed in confinement and open lot systems. Research data indicate that cattle fed in confinement or in an open lot with shelter gain faster and are more efficient than cattle fed in an open lot without shelter. Thus, in the following analyses, calves and yearlings fed in an open lot without shelter require 10 percent more feed and also gain .2 pound less per day than similar animals with shelter.

Table 5. Space requirements, animal performance, and related data for the various beef feedlot systems.

	Calves		Yearlings		
	Open lot, windbreak	Open lot, shelter	Open lot, windbreak	Open lot, shelter	Confinement
Space requirements (square feet per head capacity)					
Lot	250	250	250	250	——
Shelter	——	20	——	20	16
Animal performance (lb gain per day)					
In lot	2.10	2.30	2.50	2.70	2.70
Pay weight	1.95	2.14	2.25	2.42	2.42
Death loss	2%	2%	1%	1%	1%
Medical costs per head	$7.30	$7.30	$4.30	$4.30	$4.30
Feedlot gain per space per year (lb.)	710*	774*	845	890	890
Pay weight gain per space per year (lb.)	660	720	760	800	800
Turnover rate	1.1*	1.2*	1.9	2.0	2.0

**Except for 100-head group, where a 1.0 turnover rate was used.*

The differences between in-lot and payweight rates of gain in table 5 reflect the shrink into and out of the lot. Forty-five pounds of grain were required to cover both in and out shrink for all cattle fed. Because of this shrink, the net annual payweight gain per space for yearlings is only 800 pounds with a turnover rate of two head per year. This compares to 720 pounds of payweight gain for calves with shelter and 660 pounds for calves fed in open lot with windbreak fence.

The rations for the cattle feeding programs vary by the number of cattle fed and type of facility used. All rations allow for storage and feeding losses. Table 6 illustrates the rations for calves and yearlings.

For 100-head-capacity calf feeding programs, a dry corn and dry roughage ration is fed. For all other size groups a high-moisture corn (24% moisture) and corn silage ration is used. For calves with shelter, the feeding efficiencies used in the analysis are 6 pounds of corn dry matter per pound of gain, 8.5 pounds of silage dry matter per pound of gain, or 12.0 pounds of hay dry matter per pound of gain. Calves without shelter require approximately 10 percent more feed per pound of gain. Yearlings with shelter require about 10 percent more feed per pound of gain than calves with shelter, and yearlings without shelter require 10 percent more feed per pound of gain than yearlings with shelter.

RESOURCE REQUIREMENTS AND COSTS

Table 7 summarizes the resource requirements and costs per hundredweight of gain for the eight systems for 100-, 300-, and 600-head units. The costs and resource requirements for 1,000-, 2,500-, and 5,000-head units are summarized in table 8.

Table 6. Feedlot rations for cattle feed in open lot and confinement.

Calves	100 head	300 head and above
Calves feed in open lot with shelter or confinement; 645 lb. gain	69.7 bu. dry corn (15%) .71 ton dry hay 120 lb SBOM	57.04 bu. wet corn (24%) 3.3 ton corn silage 87 lb. SBOM 97 lb urea supplement (60% CP)
Calves fed in open lot with windbreak fence; 645 lb. gain	76.7 bu. dry corn (15%) .78 ton dry hay 132 lb. SBOM	62.7 bu. wet corn (24%) 3.63 ton corn silage 95.7 lb. SBOM 106.7 lb. urea supplement (60% CP)
Yearlings		
Yearlings fed in open lot with shelter or confinement; 445 lb. gain	57.5 bu. dry corn (15%) .31 ton dry hay 20 lb. SBOM	54.5 bu. wet corn (24%) 1.32 ton silage 30 lb. SBOM 69 lb. urea supplement (60% CP)
yearlings fed in open lot with windbreak fence; 445 lb. gain	63.2 bu. dry corn (15%) .34 ton dry hay 22 lb SBOM	60 bu. wet corn (24%) 1.45 ton corn silage 33 lb. SBOM 75.9 lb. urea supplement (60% CP)

Labor Requirements

Labor requirements include the labor used for feeding, manure disposal, and overhead activities. Overhead activities include such items as observation, sorting, handling, buying and selling cattle and feed, and other miscellaneous jobs. No allowance is made for a manager or office help. As the data in table 7 indicate, a 600-head flush gutter system for yearlings requires 1.71 hours of labor per head or 2,052 hours of total labor annually. The labor requirement is generally the largest for the open lots as compared to the confinement systems. For example, yearlings in the 300-head capacity open lot with shelter require 12 percent more labor than yearlings in a 300-head capacity cold confinement - deep pit - field spread facility.

For feedlots under 1,000-head capacity, the cattle feeding enterprise may be considered as an integral part of the total farm operation, with the farm operator supplying the majority of the labor. Feedlots of this size and smaller in general will require one full-time man for approximately 800 head of cattle. Above 1,000-head size, the labor requirements are large enough that some specialization of labor may occur. Hired labor might be employed for specific purposes such as feeding cattle, buying and selling, observation, etc. Feedlots of 2,500 head essentially become three-to-four-man operations, whereas the 5,000-head feedlot may be considered a five-to-six-man operation exclusive of a general manager.

Figure 4 depicts the labor requirement per head capacity for each size group within a particular yearling system. The labor required declines rapidly as the size of the feedlot increases to about 1,000-head capacity. Beyond this level the labor requirement per head becomes fairly constant. This indicates that most of the economies of size due to labor are achieved with feedlots of 1,000-head capacity.

Capital Requirements

Investment Capital

The investment capital figures in tables 7 and 8 represent 1974 capital requirements to design and construct the various facilities on a turn-key basis. Some farmers may reduce these investment costs by doing part of the work themselves. Others can remodel existing facilities as a means of reducing the investment capital requirement, particularly for feedlots of less than 600-head capacity.

Investment capital requirements are presented for the lot and shelter, waste handling (including a lagoon where needed), feed storage and handling and wells, sorting and handling, office, and miscellaneous equipment. Tables 7 and 8 indicate that the capital outlay for the lot and shelter remain fairly constant as feedlot size increases. The capital investment in the feedlot and shelter is approximately \$65-\$70 per head capacity for the open lot without shelter and \$100-\$105 per head capacity with shelter. The investment per head capacity in lot and shelter for confinement systems ranges from \$85-\$90 for the manure scrape system to \$140-\$145 for the slatted floor - deep pit systems. The lot and shelter capital requirements for the manure scrape and flush gutter systems closely parallel the outlay for open lots and shelter.

Table 7. Labor, capital investment, feed and non-feed costs for various beef cattle feedlot systems—100-, 300-, 600-head capacity

	Open lot windbreak fence yearlings	Open lot windbreak fence calves[5]	Open lot shelter yearlings	Open lot shelter calves[6]	Cold confinement pit-irrigation yearlings	Cold confinement pit-field spread yearlings	Cold confinement flush gutter yearlings	Cold confinement manure scrape yearlings
100-Head Capacity								
Total number fed	190	100	200	100	200	200	200	200
Labor (hours per head)	4.30	5.80	4.40	6.00	4.53	3.89	3.79	4.39
Capital (dollars per head capacity)								
Lot and shelter	$66.15	$66.15	$102.56	$102.56	$142.49	$142.49	$113.30	$86.65
Waste handling incl. lagoon	33.26	33.26	32.03	32.03	42.50	52.00	11.54	15.00
Feed storage and handling[1]	129.35	74.08	129.35	74.08	129.35	129.35	129.35	129.35
Well, office, etc.	—	—	—	—	—	—	—	—
Total	$228.76	$173.49	$263.94	$208.67	$314.34	$323.84	$254.19	$231.00
Cost (dollars per cwt. gain)								
Nonfeed costs	$12.61	$12.22	$12.74	$12.47	$13.57	$13.71	$11.86	$12.32
Feed costs	40.24[3]	39.96[2]	36.57[3]	36.34[2]	36.57[3]	36.57[3]	36.57[3]	36.57[3]
Total	$52.85	$52.18	$49.31	$48.81	$50.14	$50.28	$48.43	$48.89
Total capital investment	$22,876.00	$17,349.00	$26,394.00	$20,867.00	$31,434.00	$32,384.00	$25,419.00	$23,100.00
Total labor requirement (hours)	860	580	880	600	906	778	758	878
Acres for feed supply	136	92	122	84	122	122	122	122
300-Head Capacity								
Total number fed	570	330	600	360	600	600	600	600
Labor (hours per head)	2.30	3.80	2.40	4.00	2.21	2.25	2.12	2.39
Capital (dollars per head capacity)								
Lot and shelter	$64.40	$64.40	$100.81	$100.81	$140.73	$140.73	$111.54	$84.90
Waste Handling	22.25	22.25	19.15	19.5	18.83	17.33	7.43	6.75
Feed storage and handling	104.50	115.60	104.50	115.60	104.50	104.50	104.50	104.50
Well, office, etc.	—	—	—	—	—	—	—	—
Total	$191.15	$202.25	$224.46	$235.56	$264.06	$262.56	$223.47	$196.15
Cost (dollars per cwt. gain)								
Nonfeed cost	$10.45	$11.57	$10.60	$11.59	$10.71	$11.10	$9.90	$9.84
Feed costs[4]	41.01	36.33	37.29	33.03	37.29	37.29	37.29	37.29
Total	$51.46	$47.90	$47.89	$44.62	$48.00	$48.39	$47.19	$47.13
Total capital investment	$57,345.00	$60,675.00	$67,338.00	$70,668.00	$79,218.00	$78,768.00	$67,041.00	$58,845.00
Total labor requirement (hours)	759	1,254	1,440	1,440	1,326	1,350	1,272	1,434
Acres for feed supply	375	255	341	253	341	341	341	341
600-Head Capacity								
Total number fed	1,140	660	1,200	720	1,200	1,200	1,200	1,200
Labor (hours per head)	1.90	2.70	2.00	2.90	1.76	1.79	1.71	1.89
Capital (dollars per head capacity)								
Lot and shelter	$68.57	$68.57	$104.98	$104.98	$144.89	$144.89	$115.41	$89.07
Waste handling	16.55	16.55	15.27	15.27	20.05	12.50	4.45	7.25
Feed storage and handling	36.13	41.33	36.10	41.33	36.13	36.13	36.13	36.13
Well, office, etc.	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67
Total	$123.92	129.12	159.02	$164.25	$203.74	$196.19	$158.66	$135.12
Cost (dollars per cwt. gain)								
Nonfeed costs	$8.77	$9.28	$9.05	$9.47	$9.42	$9.44	$8.63	$8.52
Feed costs	41.01	36.32	37.29	33.03	37.29	37.29	37.29	37.29
Total	$49.78	$45.60	$46.34	$42.50	$46.71	$46.73	$45.92	$45.81
Total capital investment	$74,352.00	$77,472.00	$95,412.00	$98,550.00	$122,244.00	$117,714.00	$95,196.00	$81,072.00
Total labor requirement (hours)	1,254	1,782	2,400	2,088	2,112	2,052	2,052	2,268
Acres for feed supply	751	510	683	505	683	683	683	683

1. Fenceline feeding system: for auger or belt system allow $45.50 per head for 100 head or $45.66 per head for 300 head and above.
2. Ration consists of air-dry corn and air-dry hay.
3. Ration consists of air-dry corn and corn silage.
4. For 300-head and above, ration consists of wet corn and corn silage.
5. For 100-head unit—1.0 turnover rate; for 300 and above, 1.1 turnover rate.
6. For 100-head unit—1.0 turnover rate; for 300 and above, 1.2 turnover rate.

As size increases, the capital requirements for feed storage and handling are substantially reduced. For example, the feed storage and handling investment for the 300-head yearling systems is $104.50 per head capacity. This per head investment figure declines to $36.13 for 600-head and $26.79 for 2,500-head-capacity lots. Similarly, the waste handling investment declines with size. For the cold confinement - field spread system, the waste handling investment declines from $52 per head for the 100-head-capacity unit to $10 per head for the 2,500-head-capacity lot.

The economies of size in feed and waste storage and handling equipment substantially reduce the total investment per head as size increases. For example, the investment per head for the deep pit - field spread systems declines by $66 when size is increased from 300- to 600-head capacity. This compares to a $3 per head reduction in investment when size is increased

Table 8. Labor, capital investment, feed and nonfeed costs for various beef feedlot systems—1,000-, 2,500-, 5,000-head capacity.

	Open lot windbreak fence yearlings	Open lot windbreak fence calves	Open lot shelter yearlings	Open lot shelter calves	Cold confinement pit-irrigation yearlings	Cold confinement pit-field spread yearlings	Cold confinement flush gutter yearlings	Cold confinement manure scrape yearlings
1000-Head Capacity								
Total number fed	1.900	1.100	2.000	1.200	2.000	2.000	2.000	2.000
Labor (hours per head)	1.70	2.50	1.80	2.70	1.62	1.71	1.59	1.79
Capital (dollars per head capacity)								
Lot and shelter	$66.70	$66.70	$103.11	$103.11	$142.88	$142.88	$113.73	$87.20
Waste handling	14.67	14.67	12.42	12.42	13.23	12.50	4.52	5.80
Feed storage and handling	30.13	36.02	30.13	36.02	30.14	30.13	30.13	30.13
Well, office, etc.	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Total	$113.50	$119.39	$147.66	$153.55	$188.25	$187.51	$150.38	$125.13
Cost (dollars per cwt. gain)								
Nonfeed costs	$8.45	$9.06	$8.72	$9.27	$8.96	$9.21	$8.31	$8.25
Feed costs	41.01	36.32	37.29	33.03	37.29	37.29	37.29	37.29
Total	$49.46	$45.38	$46.01	$42.30	$46.25	$46.50	$45.60	$45.54
Total capital investment	$113,430.00	$113,430.00	$147,660.00	$153,550.00	$188,250.00	$187,510.00	$150,380.00	$125,130.00
Total labor requirement (hours)	3.400	3.000	3.600	3.240	3.240	3.400	3.180	3.580
Acres for feed supply	1.251	849	1.138	842	1.138	1.138	1.138	1.138
2,500-Head Capacity								
Total number fed	4.750	2.750	5.000	3.000		5.000	5.000	
Labor (hours per head)	1.62	2.42	1.72	2.62		1.61	1.53	
Capital (dollars per head capacity)								
Lot and shelter	$67.10	$67.10	$103.51	$103.51		$143.29	$114.14	
Waste handling	16.18	16.18	14.88	14.88		10.00	4.98	
Feed storage and handling	26.79	31.80	26.79	31.80		26.79	26.79	
Well, office, etc.	4.40	4.40	4.40	4.40		4.40	4.40	
Total	$114.40	$119.48	$149.28	$154.59		$184.48	$150.31	
Cost (dollars per cwt. gain)								
Nonfeed costs	$8.17	$8.76	$8.46	$8.98		$9.07	$8.25	
Feed costs	41.01	36.32	37.29	33.03		37.29	37.29	
Total	$49.18	$45.08	$45.75	$42.01		$46.36	$45.54	
Total capital investment	$286,100.00	$286,100.00	$373,200.00	$386,475.00		$461,200.00	$375,775.00	
Total labor requirement (hours)	8.100	7.260	8.600	7.860		8.050	7.650	
Acres for feed supply	3.128	2.123	2.844	2.106		2.844	2.844	
5,000-Head Capacity								
Total number fed	9.500	5.500	10.000	6.000		10.000	10.000	
Labor (hours per head)	1.50	2.30	1.60	2.50		1.58	1.42	
Capital (dollars per head capacity)								
Lot and shelter	$65.10	$65.10	$101.51	$101.51		$141.29	$112.14	
Waste handling	13.59	13.59	13.46	13.46		10.00	5.19	
Feed storage and handling	22.84	26.58	22.84	26.58		22.84	22.84	
Well, office, etc.	4.15	4.15	4.15	4.15		4.15	4.15	
Total	$105.68	$109.42	$141.96	$145.70		$178.28	$144.32	
Cost (dollars per cwt. gain)								
Nonfeed costs	$7.90	$8.49	$8.20	$8.72		$8.83	$8.03	
Feed costs	41.01	36.32	37.29	33.03		37.29	37.29	
Total	$48.91	$44.81	$45.49	$41.75		$46.12	$45.32	
Total capital investment	$538,250.00	$538,050.00	$709,800.00	$728,500.00		$891,400.00	$721,600.00	
Total labor requirement	15.000	12.650	16.000	15.000		15.800	14.200	
Acres for feed supply	6.256	4.246	5.688	4.211		5.688	5.688	

from 1,000 to 2,500 head. Figure 5 illustrates the per head investment requirements for the different yearling systems.These data suggest that most economies of size due to capital requirements occur for feedlots up to 1,000-head capacity.

The differences in the capital investment among the confinement systems are caused primarily by the waste handling technology. Some waste handling methods, particularly the deep pit - field spread or irrigation systems are more capital intensive than other systems. However, these capital intensive systems use less labor. For example, the waste handling labor requirement for the deep pit-field spread system is approximately half the labor needed for the solid floor - manure scrape system.

The total capital investment in facilities and equipment increases significantly from the open lot to the confinement systems. In fact many of the confinement systems require approximately 40 to 50 percent more capital outlay than the open lot systems. The total capital investment for a 1,000-head open lot without shelter for yearlings is approximately $113,000 compared with approximately $188,000 for a deep pit confinement system. The total investment for the two calf systems is slightly greater than the total investment for the comparable yearling systems. This difference is

due to the feed storage requirements, since storage was provided for all roughage consumed during the year.

Some Iowa cattle feeders are contemplating expansion of their present open lots, while others are making improvements to meet Environmental Protection Agency standards for runoff control. Table 9 summarizes estimates of the capital required to modify open lots for expansion or to meet environmental regulations. For example, consider a cattle feeder with a 300-head-capacity lot who must add pollution control improvements to comply with current EPA regulations. His added capital investment would be $1,314 for a retention pond, settling basin, and diversion terrace to handle liquid runoff. If irrigation equipment was purchased, this would add $1,430 more to his investment. A cattle feeder who is currently feeding 100 head per year in an open lot would have to invest approximately $4,100 for a pole building and $3,000 for concrete feedbunks to add shelter and modernize his facility.

Operating Capital

Operating capital includes the capital necessary to buy the feeder animal and 50 percent of the feed inventory necessary to produce the weight gain. With $2.50 per bushel corn, $35 per hundredweight calves and $30 per hundredweight yearlings, operating capital requirements amount to approximately $265-$275 per head for calves and $290-$300 for yearlings. The 100-head feedlot feeding yearlings requires operating capital of approximately $30,000 compared with $90,000 for a 300-head feedlot. This can be compared with $1.5 million operating capital for a 5,000-head capacity lot. A $1 per hundredweight change in the purchase price of calves or yearlings changes the operating capital requirements by $4.50 and $7 per head, respectively. A 10-cent change in the price of corn changes the operating capital requirements by about $2.75 per head.

Land Requirements

Tables 7 and 8 also summarize the acres of land needed to produce the grain and roughage required by the different systems. Note that the land requirement for calves is only about 65 to 70 percent of the requirement for yearlings in all systems. For yearlings in confinement, the land requirement increases from 122 acres for a 100-head-capacity unit to 1,138 acres for 1,000 head and 5,688 for 5,000 head.

The pounds of beef produced per acre varies by system because of differences in the ration fed, feeding efficiency, and rate of gain. For the wet corn and corn silage ration, 607 pounds of beef per acre are produced by yearlings without shelter compared to 702 pounds of beef per acre by yearlings with shelter. The calf systems produce 766 pounds and 855 pounds per acre for systems without and with shelter, respectively.

Costs

Nonfeed costs per hundredweight of gain include the costs for labor, fixed costs on buildings, facilities and equipment, interest on the feed and livestock inventory, and direct cash costs such as veterinary expense, power expense, etc. For the 300-head-capacity yearling systems, the nonfeed cost varies from $9.84 per hundredweight for the cold confinement - manure scrape system to $11.10 for the cold confinement - deep pit - field spread system. The nonfeed costs for yearlings in open lot are about $1 less than for calves with a 300-head-capacity facility.

Table 9. Modifications to beef feedlot systems for feedlot expansion or installing pollution control devices.[1]

	Investment by feedlot size		
Item	100 head	300 head	600 head
1. Pole buildings for shelter @ 20 sq ft/head	$4,100	$12,300	$24,600
2. Add concrete feed bunks and platform	3,000	9,000	18,000
3. Building mounds	315	1,125	2,250
4. Retention pond, settling basin, and diversion for runoff control[1]	633	1,314	2,289
5. Disposal system including irrigation equipment[1]	520	1,430	1,870

1. Capital requirements needed if these size groups were to come under current EPA regulations for feedlots over 1,000 head capacity.

Fig. 4. Labor requirement per head by system and size.

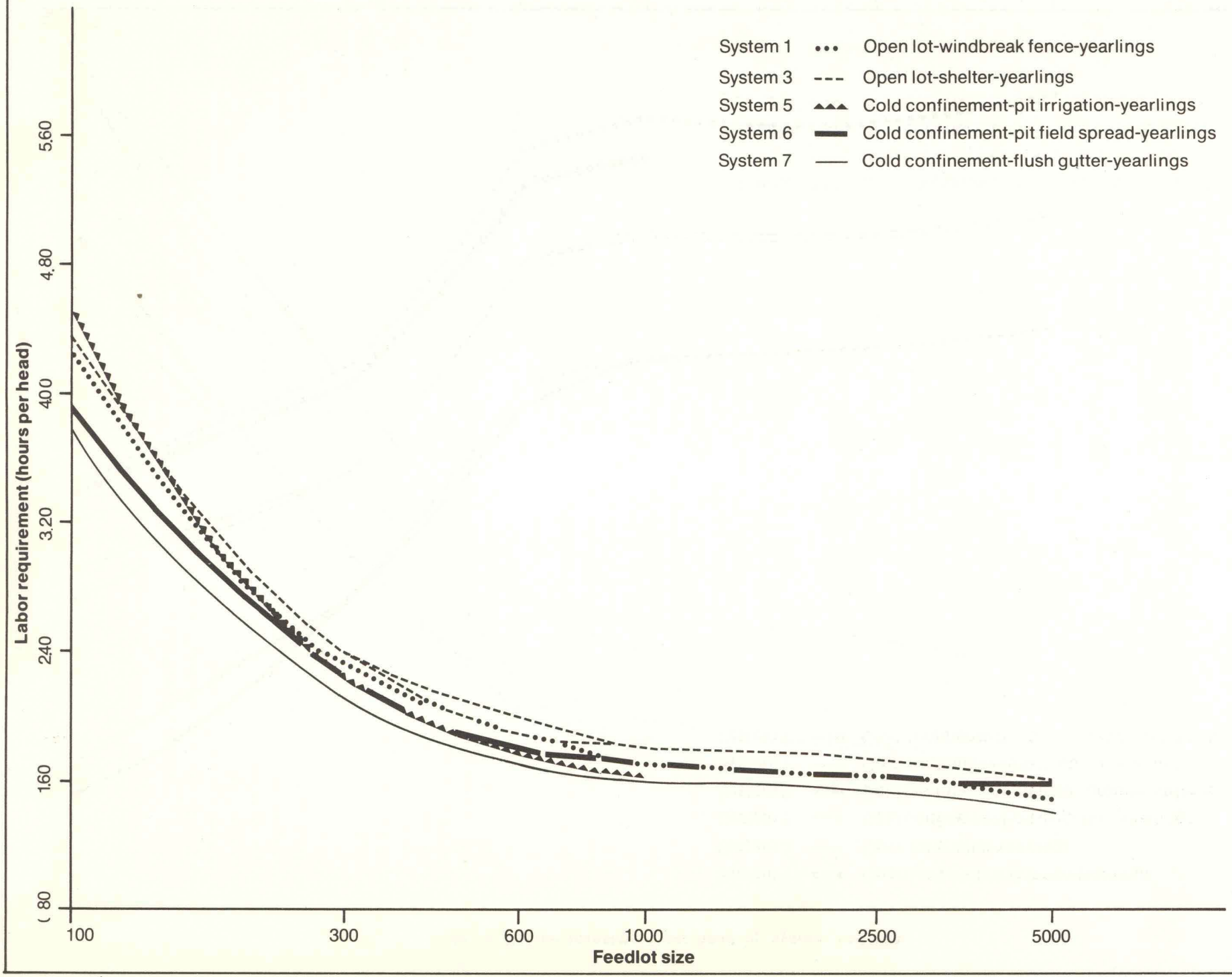


Fig. 5. Capital investment per head by system and size.

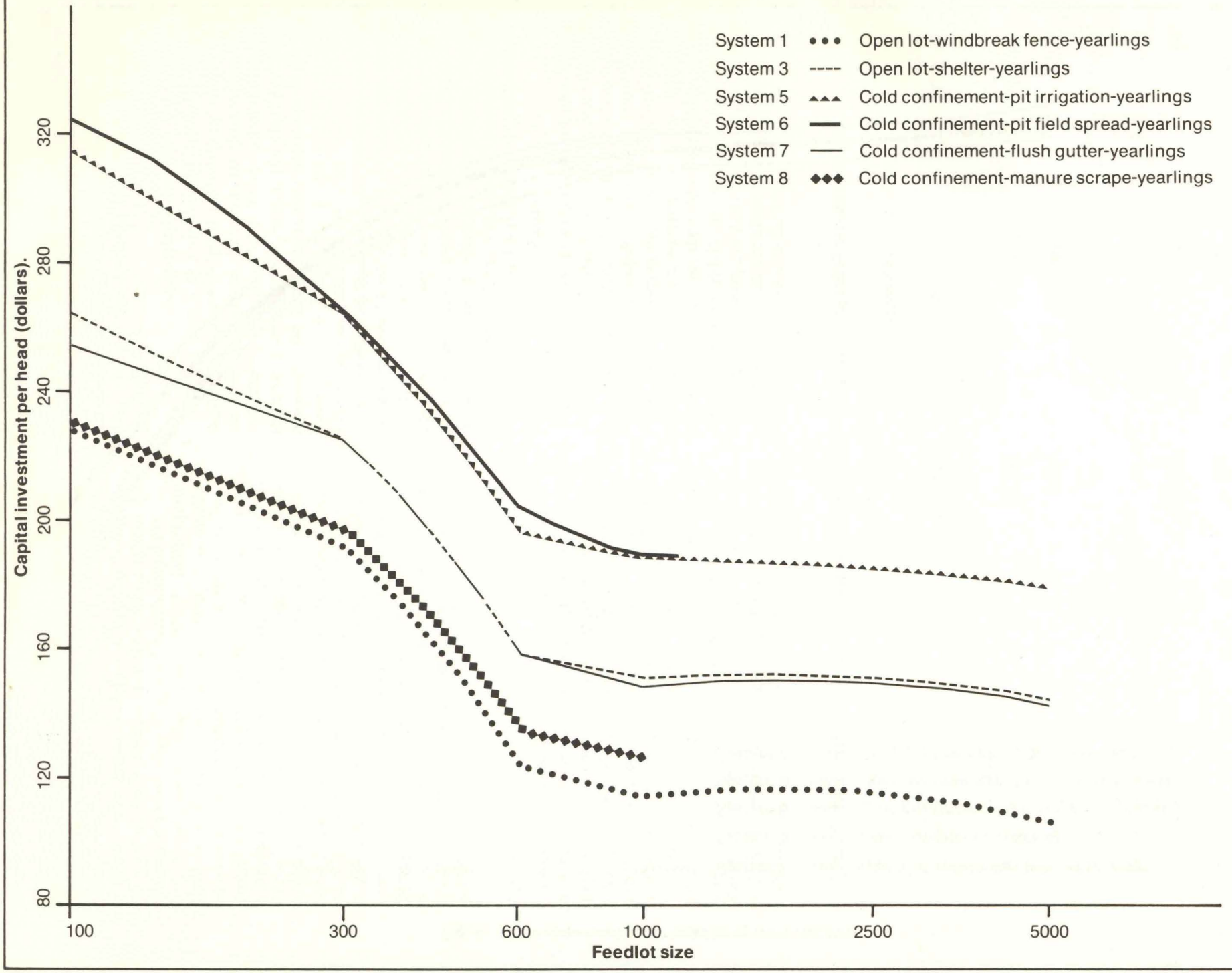
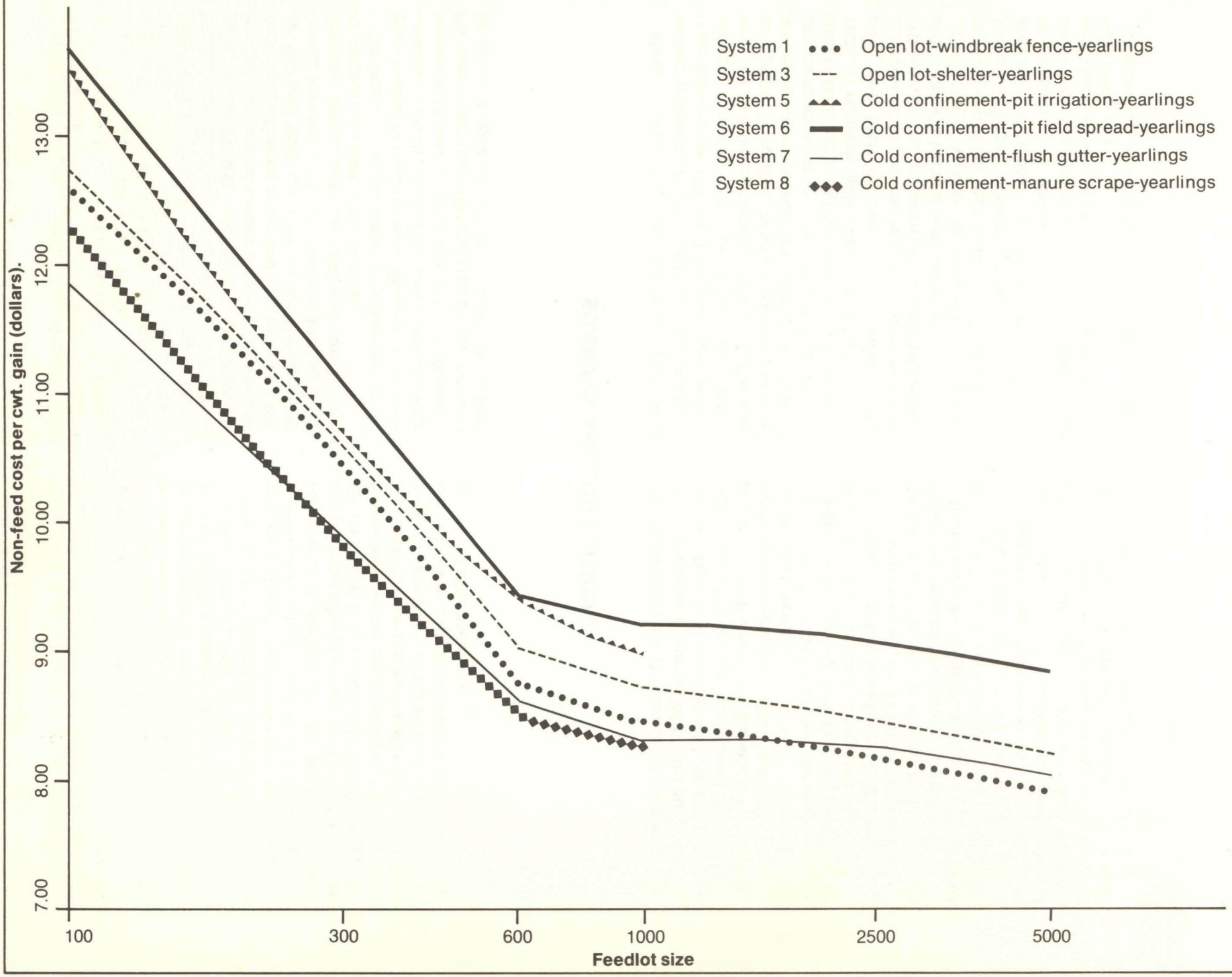


Fig. 6. Nonfeed cost per hundredweight gain by system and size.



Nonfeed costs decline substantially as feedlot size increases for all systems (figure 6). For the yearlings in an open lot with shelter, the nonfeed costs decline from $12.74 per hundredweight for a 100-head-capacity feedlot to $8.20 per hundredweight gain for a 5,000-head feedlot. However, the reduction in nonfeed costs per hundredweight gain is less rapid after a feedlot has reached approximately 1,000-head capacity. For example, with the cold confinement - deep pit - field spread system, there is a $2.61 per hundredweight difference in nonfeed costs between a 100- and 300-head feedlot, a $1.66 per hundredweight difference between a 300- and 600-head feedlot, a $.23 difference between 600 and 1,000 head, and $.14 difference between 1,000 and 2,500 head.

The feed costs for the different systems reflect the type of ration fed and the feed efficiency. Feed costs are higher for both calves and yearlings without shelter because of the lower rate of gain and feed efficiency. For units larger than 100-head capacity the feed cost for calves in open lot with shelter is $33.03 per hundredweight, more than $3 lower than the $36.33 cost for calves without shelter. The higher feed cost for the 100-head lots occurs because of the use of dry hay rather than corn silage in the ration.

The data in tables 7 and 8 indicate that for all sizes, the total costs (feed plus nonfeed) are lower for cattle in shelter compared with open lots without shelter. For the 300-head-capacity units, shelter reduces the cost per hundredweight of gain for yearlings and calves by $3.35 and $3.28, respectively, compared with open lots and a windbreak fence. For the yearling systems above 600 head that include shelter (open lot with shelter or confinement), the differences in total cost per hundredweight of gain are minimal. For example, for the 600-head yearling units with shelter the difference between the highest and lowest cost system is only about $.90 per hundredweight of gain. Thus, for a given size the major determinant of which system to use may not be cost but the relative availability of the capital and labor resources.

SUMMARY AND CONCLUSIONS

There are substantial economies of size in all cattle feeding systems analyzed. Significant cost reductions occur between the 100- and 1,000-head capacity lots, with approximately 75 percent of the cost reduction from 100- to 600-head capacity. Although further cost economies are achieved beyond 1,000 head, the cost reductions are rather small. The cost reductions as lot size increases occur in labor cost and fixed costs related to feed storage and handling and waste handling. There is relatively little difference in feed costs or other cash costs by size of lot assuming similar management. In practice there will be differences in all of these costs between different sizes and different lots of the same size because of management.

Confinement systems are competitive on a cost basis with open lots, particularly in size categories of 300 head or larger. Although confinement systems require more investment capital than open lots, they can be operated with less labor. Thus, the relative availability of capital in relation to labor, rather than cost, should be a major determinant of the cattle feeding system to use.

Confinement systems also provide more control over the environment, thus reducing the adverse effect of weather on performance. With better environmental control, the rate of gain and feed efficiency may be higher. In addition, the confinement systems will usually meet EPA and Iowa Department of Environmental Quality regulations with less difficulty and cost than those of open lots.

For both calves and yearlings, the total costs per hundredweight are substantially lower for open lot systems with shelter compared to only a windbreak. Even though higher nonfeed costs are incurred with a building, the $3.30 per hundredweight reduction in feed cost because of better feed efficiency in shelter more than offsets the higher nonfeed costs.

In analyzing the competitive position of Iowa cattle feeders, it must be recognized that they have several attractive alternative uses for their capital, labor, management, and grain resources. However, Iowa feeders have access to excellent markets because of the many slaughtering facilities in or near the state. With the adoption of new technology and production methods, Iowa farmers will continue to be a competitive and major source of high-quality fed beef.

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