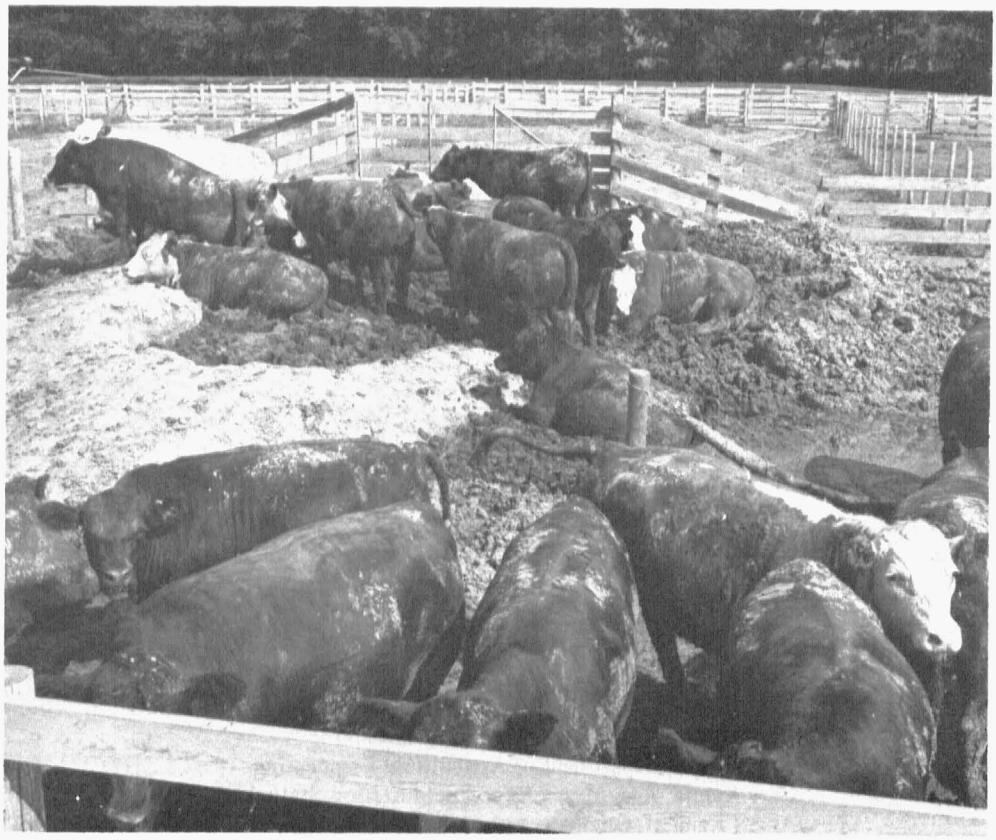
Report of Third and Fourth Tests
Weldon Springs Experimental Feedlots

CATTLE FEEDLOT FACILITIES And MANAGEMENT



A mound that broke down under stress of too little space per head.

SR122 - 7/70/3.5M UNIVERSITY OF MISSOURI AGR. EXP. STATION

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CATTLE FEEDLOT FACILITIES AND MANAGEMENT STUDY

A Progress Report on the Third and Fourth Tests at the University's Weldon Spring Experimental Feedlots.

The primary objective of this series of tests was to compare the effects of various feedlot facilities upon the performance of cattle handled under good systems of management. All cattle were fed the same ration and handled alike so that the differences in performance could be attributed to facilities.

Descriptions on following pages detail the outside lots and the facilities in each. The main features of each lot are listed along with a summary of materials used and construction costs. Drawings and discussion of the open-fronted confinement barn, first used during the third and fourth tests, are also included. The listings of materials, equipment, and labor costs for each lot are valuable for a comparison of the various facilities. In reviewing these figures, one must remember that costs will vary considerably according to location, labor requirements, availability of raw materials, and many other factors. Furthermore, the lots are not as large as those used by commercial lots; consequently, the investment per unit capacity may be greater in these tests.

In the third test, various outside lots were compared with lots in the confinement facility for finishing cattle during the 140-day period, Jan. 9, 1968 to May 28, 1968, and during the 56-day period, May 28, 1968 to July 23, 1968. The fourth test of cattle feedlot facilities involved two systems of management. Under one system, cattle were finished in the various facilities during the winter period, Jan. 21, 1969 to May 1, 1969. Under the second management system, other lots of cattle were fed a growing ration during the 140-day winter period and were reallotted in May to study the various facilities during the finishing period from May 22 to Aug. 28, 1969. The detailed results of these tests are discussed in this report along with observations regarding practical management of feedlot facilities.

Description of Facilities

LOT #1 DISTINCTIVE FEATURES

1. 30' x 48' clear span shed.
2. 12' concrete apron along feed bunk.
3. 15' concrete apron along front of shed with 3' extending into interior.
4. 10' concrete apron connecting feed bunk apron with shed apron.

MATERIALS & EQUIPMENT

	Costs
Fencing	$ 359
Feed bunks & concrete area	852
Water system	231
Equipment charge	103
Shed	1271
Total	$2816

LABOR

	Hours
Fencing	307
Concrete & bunks	141
Site preparation	30
Water installation	43
Other	12
Shed construction	370
Total	903

LOT #2 DISTINCTIVE FEATURES

1. 12' concrete apron along feed bunk[1].
2. 24' wide limestone area.
3. Manure storage pit.

MATERIALS & EQUIPMENT

	Costs
Fencing	$ 412
Feed bunk & concrete area	539
Water system	231
Equipment charge	103
Rock & lime	26
Total	$1311

LABOR

	Hours
Fencing	254
Concrete & bunks	91
Site preparation	41
Water installation	43
Others	12
Total	441

[1]Feed bunks were covered in lots 2A, 4A, and 5A during the winter period of the fourth test at a cost of $101.62 per lot.

LOT #3 DISTINCTIVE FEATURES

1. 12' concrete apron along feed bunk.
2. 15' concrete slab with 3/4" per ft. slope.
3. Manure storage pit.

MATERIALS & EQUIPMENT

	Costs
Fencing	$ 459
Feed bunk & concrete area	839
Water system	231
Equipment charge	103
Total	$1632

LABOR

	Hours
Fencing	277
Concrete & bunks	139
Site preparation	41
Water installation	43
Others	12
Total	512

LOT #4 DISTINCTIVE FEATURES

1. 12' concrete apron along bunk[1].
2. Dirt mound covered with limestone.

MATERIALS & EQUIPMENT

	Costs
Fencing	$ 383
Feed bunk and concrete area	584
Water system	231
Equipment charge	103
Lime (for mound)	81
Total	$1382

LABOR

	Hours
Fencing	283
Concrete & bunks	91
Site preparation	53
Water installation	43
Others	12
Total	482

LOT #5 DISTINCTIVE FEATURES

1. 12' concrete apron along bunk[1].
2. Dirt lot.
3. Sun shade in 5B.

MATERIALS & EQUIPMENT	Costs	LABOR	Hours
Fencing	$ 376	Fencing	279
Feed bunk & concrete area	584	Concrete & bunks	91
Sun shade		Site preparation	30
Water system	231	Water installation	43
Equipment charge	103	Other	12
Total		Total	455

LOT #6 DISTINCTIVE FEATURES

1. Third test: 2' concrete apron along feed bunk.
2. Fourth test: Concrete apron along bunk extended to 8' in Lot 6A, and 6' in Lot 6B.
3. Dirt lot.

MATERIALS & EQUIPMENT	Costs	LABOR	Hours
Fencing	$ 345	Fencing	254
Feed bunk & concrete area	584	Concrete & bunks	55
Water system	231	Site preparation	30
Equipment charge	103	Water installation	43
Total	$1263	Other	12
		Total	394

LOT #7 DISTINCTIVE FEATURES

1. 12' concrete apron along bunk.
2. Dirt lot.
3. Pasture access (was not used during the third and fourth tests).

MATERIALS & EQUIPMENT	Costs	LABOR	Hours
Fencing	$ 332	Fencing	254
Feed bunks & concrete area	584	Concrete & bunks	91
Water system	231	Site preparation	30
Equipment charge	103	Water installation	43
Total	$1250	Other	12
		Total	430

CONFINEMENT BARN

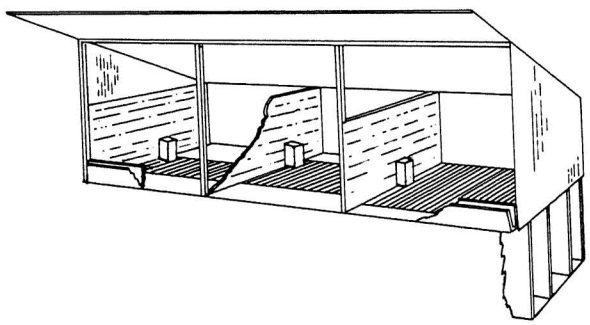
Lot No. 8	Lot No. 9	Lot No. 10
(1) 1/3 slotted floor	(1) 2/3 slotted floor	(1) Fully slotted floor
(2) Open front to the South	(2) Open front to the South	(2) Open front to the South
(3) 18' width by 26' depth	(3) 18' width by 26' depth	(3) 18' width by 26' depth

[1]Feed bunks were covered in lots 2A, 4A, and 5A during the winter period of the fourth test at a cost of $101.62 per lot.

Construction costs of the confinement barn

Cost of materials - $6,872.38
Labor - hours 1,836
Labor cost - $4,541.34
Total cost - $11,413.72

The above figures on construction costs of the confinement barn should only be used as guide. Since this confinement building was constructed to provide three different research lots, each relatively small (16 head each), the cost per head capacity was high. The exact costs of the individual pens (lots 8, 9, and 10) were not available; however, the construction cost per head capacity increased with increased slotted floor area and the corresponding larger manure pits.



Facilities and Equipment

Outside lots

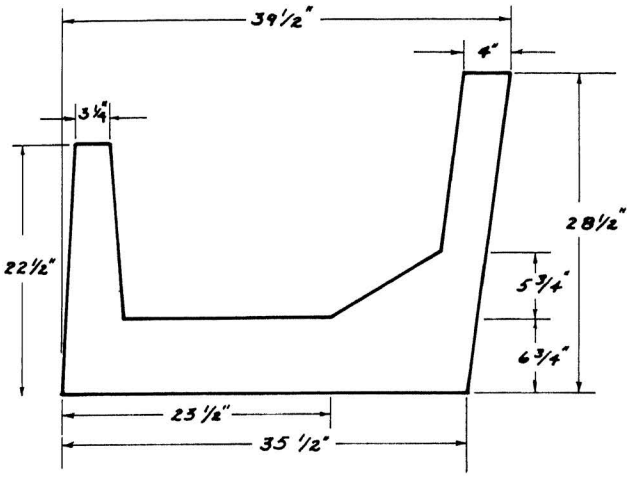
The outside lots had a southeastern exposure and the grade ranged from 4 to 6 percent. Initially, all outside lots had 80 linear feet of bunk space. With the exception of lot 1, each lot was subdivided equally into an "A" portion and a "B" portion prior to the second test. Thus, the A and B portions (lots) were duplicates of one another, each with 40 linear feet of bunk space. All lots were approximately 188' in length.

Feed bunks were assembled from pre-cast concrete units with one edge of the bunk resting on the concrete apron and the other edge resting on concrete piers. These concrete piers were located at each junction of the 8' bunk sections. A 3' opening was left between bunks at each lot division fence for easy access to the lot. After one year's use a change was made in the bunks. At the mid-point of each 80' span of bunks, the bunk bottom was built up with approximately 4" of concrete; this thickness was reduced gradually from 4" at the mid-point to 0" at each end. This allowed the water to drain out at the ends and permitted small calves (300-400 lbs.) to reach the bottom of the feed bunk. A cross-section of the feed bunk and detailed dimensions can be seen in figure 1.

Lots 2A, 2B, 4A, 5A, and 5B had a 12' concrete pad along the feed bunk. The 2' wide concrete pad in lots 6A and 6B was extended in the fall of 1968 to 8' in lot 6A and 6' in lot 6B. A 27 foot slab of concrete extended from the feed bunk in lots 3A and 3B. Cattle traffic kept approximately 6' of the pad in all lots free of manure build-up.

During the third test, all outside lot cattle had 200 square feet per head. In the winter of the fourth test, all outside lots provided 200 square feet of space per head except lot 4A in which cattle were confined to 42 square feet of total area per head allowing 32 square feet per steer on the mound itself. Lots 2A and 4A were restricted to 50

Fig. 1 – Cross section of concrete feed bunks.



1. At the mid-point of an 80' span of bunks, the bottom was built up with about 4" of concrete. From this mid-point, the concrete thickness was reduced gradually from 4" to 0" at the ends. This did two things:
   (a) Permitted small calves (300-400#) to reach the bottom of the feed bunk, and
   (b) Caused water to drainout at the ends.
2. Forward edge rests on a concrete pad.

square feet per head during the summer period of the fourth test. This concentration of cattle put the mound under stress and enabled a comparison between outside lot cattle with restricted area and cattle in the confinement barn.

The limestone covered mounds stayed dry and firm when the other lots became extremely muddy during the third test. Even so, after two years of continuous use, some deterioration had occurred and the mound in lot 4A was rebuilt prior to the fourth test. After the winter period of the fourth test, the limestone covered mound in lot 4A (stressed) was again in very bad condition. Large potholes had developed in the mound. In lot 4B, the mound was in better condition than in 4A. Nevertheless, neither was satisfactory and both required reconditioning. Cattle in 4B preferred to use the lower, flat portion of the lot for resting rather than the mound, in the proportion of three to one. The cattle in 4A, of course, had no choice but to stay on the mound.

Automatic waterers were used. A concrete pad surrounded each waterer and connected with the feed bunk apron. Water spillage was minimized by reducing the water pressure to 30 lbs. per square inch. However, the areas around the waterers were wet and sloppy during most of the winter periods of both the third and the fourth tests. Drainage away from the waterer and the front edge of the mounds in lots 4A and 4B was particularly unsatisfactory.

The sunshades in lots 5A and 5B were of two types. The shade in lot 5A was simply snow fence. The shade in 5B was sheet metal which was painted white on top to reflect the sun, and black on the bottom to absorb radiation from surrounding ground surfaces and the cattle. During the first test, observations were that cattle preferred the solid-topped, sheet metal shade to the slatted, snow fence shade when allowed access to both types. Therefore, the snow fence shade in lot 5A was removed. The cattle in lot 5B were not allowed access to the shade during the wintering periods. During the summer periods of the third and fourth tests, cattle in lot 5B were allowed access to the sheet metal shade.

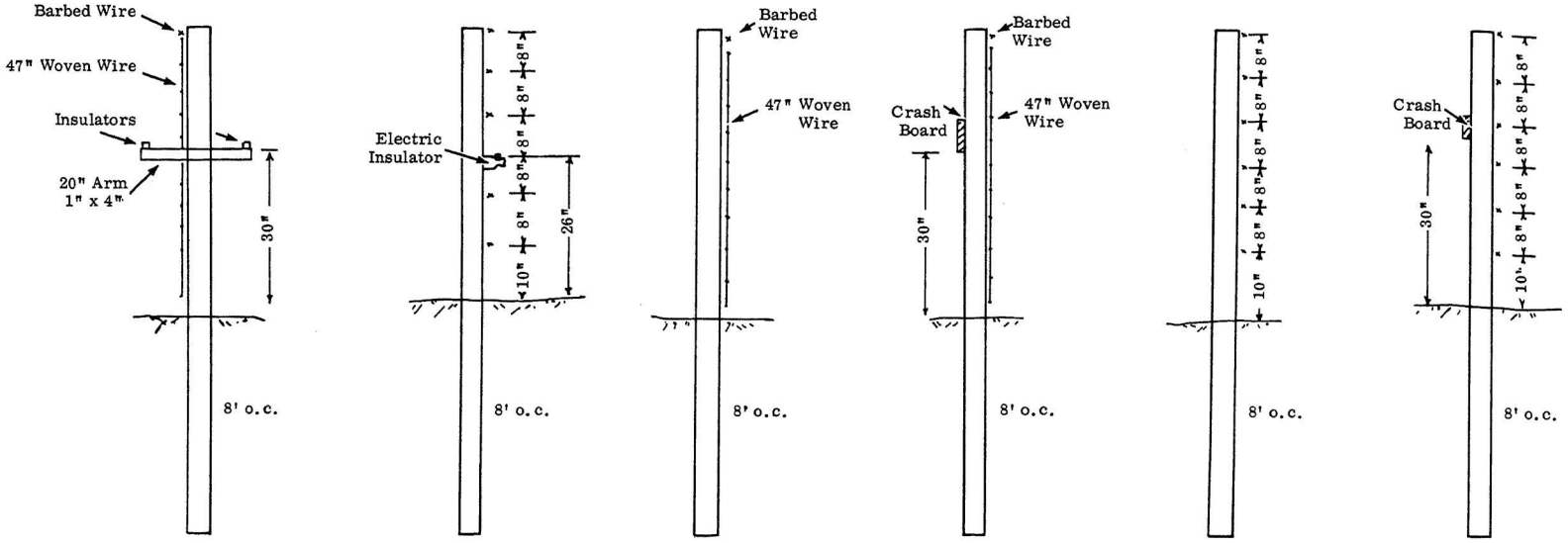
The primary lot division fences were constructed with five cables spaced 10" apart. The cable fence did not prevent cattle from slipping through when they were either excited or crowded against the fence. Six cables would have been more desirable. Cable fences used over a short span require that corner posts be set in concrete or properly anchored in some other way if cable tension is to be maintained. Tension of the 1/8" cable was easier to maintain than of the 3/8" cable.

Prior to the second test and continuing through the third and fourth tests, the lots (excluding lot 1) were divided in half. A study of several different types of division fences was made: (1) a woven wire fence with electrically-charged barbed wire set 10" out; (2) a six-strand barbed wire fence, with one strand electric; (3) a 47" woven wire fence with a barbed wire at the top; (4) a 47" woven wire fence with a 1" x 6" crash board on one side; (5) a six-strand barbed wire fence; and (6) a six-strand barbed wire fence with a crash board. Illustrations on page 6 describe the details of these fences.

Fences protected by electrically-charged wire proved very satisfactory. The non-electric barbed wire fences frequently had loose or broken strands from cattle continuously rubbing them. The woven wire fence required continuous tightening and repair and needed to be replaced after two years. Fences with a crash board prevented cattle which were unaccustomed to lot fences from running through them when excited. Thus, fences with a crash board were effective as lot division fence except for an occasional broken board; 2" crash boards would need less repair.

During the winter period of the fourth test, canvas was used to cover feed bunks in lots 2A, 4A, and 5A to protect the feed. Canvas was used to keep costs at a minimum. The bunk covers kept the feed dry most of the time. Little difference was noted, however, in the amount of feed refused when comparing covered versus non-covered bunks. The canvas feed bunk covers did have several drawbacks. Because of their design, the covers had to be raised for each feeding and heavy snow made the task difficult. Furthermore, the cattle used the feed bunk covers as a windbreak during bad weather. This resulted in crowding near the feed bunk and more dung getting into the feed. This did not occur in the non-covered bunk lots.

Rats infested the fenceline bunk areas in the fall but were controlled successfully with carbon monoxide. This job was accomplished by closing all entrances to the rodents' burrows beneath each 80' section of bank except



LOT 2 FENCE DETAIL

WOVEN WIRE & ELECTRIC
Use Pressure Treated Posts
4" Top Diameter
8' Long
Use Double Brace Panel Each End
Place Barbed Wire 3" Above Woven Wire
Electric Wire of Light Weight Barbed Wire
Man Hours Labor - 44 1/2
Cost of Materials and Labor - $113.30

LOT 3 FENCE DETAIL

BARBED WIRE & ELECTRIC
Use Pressure Treated Posts
4" Top Dia., 8' Long
Use Double Brace Panels each end
Electric Wire to be regular barbed wire
Man Hours Labor - 47
Cost of Material and Labor - $91.50

LOT 4 FENCE DETAIL

WOVEN WIRE
Use Pressure Treated Posts
4" Top Dia., 8' Long
Use Double Brace Panels Each End
Place Barbed Wire 3" Above Woven Wire
Man Hours Labor - 32 1/2
Cost of Material and Labor - $95.10

LOT 5 FENCE DETAIL

WOVEN WIRE & CRASH BOARD
Place Crash Board On Lot A Side
Use Pressure Treated Posts
4" Top Dia., 8' Long
Use Double Brace Panels Each End
Place Barbed Wire 3" Above Woven Wire
1" x 6" Crash Board, rough, Pressure Treated
Man Hours Labor - 51
Cost of Material and Labor - $136.20

LOT 6 FENCE DETAIL

BARBED WIRE
Use Pressure Treated Posts
4" Top Dia., 8' Long
Use Double Brace Panels Each End
Man Hours Labor - 40
Cost of Materials and Labor - $96.00

LOT 7 FENCE DETAIL

BARBED WIRE & CRASH BOARD
Use Pressure Treated Posts
4" Top Dia., 8' Long
Use Double Brace Panels Each End
1" x 6" Crash Board, rough, Pressure Treated
Man Hours Labor - 35 1/2
Cost of Material and Labor - $101.75

one; at this opening, exhaust fumes from a motor vehicle were discharged into the burrows to kill the rats.

External parasites were controlled with toxaphene and oil applied to back rubbers. Muddy conditions developed beneath the back rubbers because of to their frequent use.

Costs of outside lot maintenance required are given in table 1.

TABLE 1

MAINTENANCE OF OUTSIDE LOTS (1968-69)

Lot No.	Material	Cost
1	Gravel screenings--floor of the shed, edge of the feed bunk pad, and under the back rubber. (52.35T.)	$70.67
2A	Limestone--upper portion of the lot (15.15 T.)	29.54
2B	Limestone--upper portion of the lot (13.4 T.)	26.13
3A	Gravel screening--lower edge of the concrete area (2.85 T.)	3.85
3B	Gravel screening--lower edge of the concrete area (5.5 T.)	7.43
4A	Limestone--applied to the top of the mound (7.5 T.)	14.63
4B	Limestone--applied to the top of the mound (6.95 T.) Gravel screenings--under the back rubber (3.75 T.)	13.55 5.06
5A	Gravel screenings--behind the feed bunk pad and under the back rubber (6.55 T.)	8.84
5B	Gravel screenings-behind the feed bunk pad (20.25 T.)	27.34
6A	Gravel screenings--behind the feed bunk pad (12.32 T.)	16.63
6B	Gravel screenings--behind the feed bunk pad (12 T.)	16.20
7A	Gravel screenings--behind the feed bunk pad and under the back rubber (7.15 T.)	9.65
7B	Gravel screenings--behind the feed bunk pad and under the back rubber (14.35 T.)	19.37

These costs were incurred by the end of the 1968-69 winter period of the fourth test. They did not represent annual costs in all cases; they were cumulative. They did indicate areas within outside lots which required maintenance. These areas include: (1) open shed floor, (2) edge of the feed bunk concrete pad, (3) beneath the back rubber, (4) any limestone covered area, especially if severely stressed.

Confinement barn

The confinement barn was 26' by 54' and contained three pens, each 18' wide and 26' long. The barn had an open front to the south. Sliding overhead garage doors formed the north wall. The garage doors were closed in winter, opened in summer. They made a windbreak in winter, and, when opened in summer, helped to create a breezeway. The breeze in summer was from either the southwest or southeast. Thus, air flow was as good as could be obtained naturally. The pitch of the roof and overhang were constructed to permit sunlight to the back of the pens in winter and to exclude it in summer.

The underside of the roof and the inside of the west wall were insulated with 3" of fiberglass material for increased cattle comfort and to reduce the environmental temperature variation among the confinement lots due to

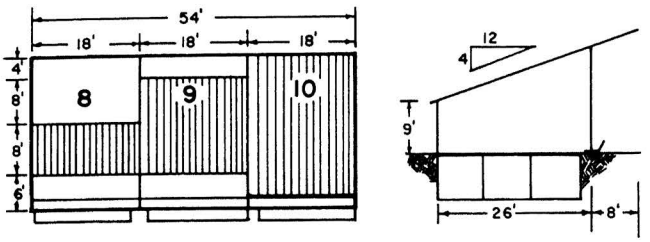


Fig. 2 –

their location within the barn.

The floors were slotted varying amounts. One third of the floor space in lot 8 was slotted, 2/3 in lot 9, and completely slotted in lot 10. Refer to figure 2 for a drawing of the floor plan and building cross-section. The solid portion of the floors in lots 8 and 9 had an 8 percent slope.

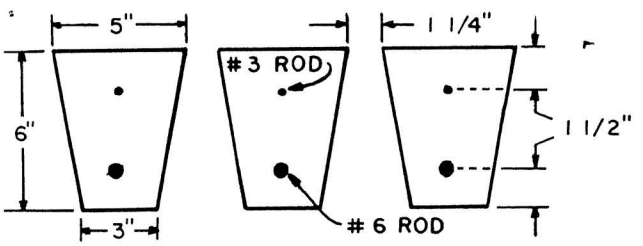


Fig. 3 –

The concrete slats were prepoured using Fairfield forms. The slats were 6" deep, 5" wide at the top, and tapered to a width of 3" at the bottom. Each slat contained two steel rods for reinforcement. The slats were placed 1¼" apart and set in place with mortar. (See example –Fig. 3)

An 8' deep manure collection pit was constructed under the slotted floor portion of each pen. Clean-out wells extended beyond the outer walls of the barn to facilitate manure removal. The pit was emptied with a liquid manure pump and agitator into a liquid manure wagon and spread on surrounding fields.

Observations made when the pits were emptied at the end of the previous test included the following:

(1) the crust which formed atop the manure had to be broken by back-flushing and

(2) proper mixing of the materials was important to prevent drawing off only the liquid portion.

The sixteen steers allotted to each pen had 29 square feet of space per steer. The cattle kept the slotted areas relatively clean. However, a small amount of manure did accumulate on the solid portions of the floor and around the edges of the pens. Compared to the cattle in the outside lots, the cattle in confinement were clean. Cattle in lot 10 (completely slotted) were the cleanest, followed by the cattle in lot 9 and last, those in lot 8.

Confinement to concrete slats did not cause any noticeable feet or leg problems in the cattle.

REPORT OF THE THIRD TEST

The 1967-68 test was the third in a series designed to study the effect of feedlot facilities upon the performance of cattle. Eleven of the original thirteen outside lots and three pens in the new confinement barn were used during the 140-day finishing test from Jan. 9 to May 28, 1968.

Weaner calves from two sources were obtained: Group One–383 head of steers and heifers delivered by Armour and Company on Nov. 10, 1967 from a ranch in Wyoming; Group Two–64 head of steers purchased through the Producers Livestock Marketing Association at Marshall, Mo., from a ranch in Arkansas.

For this facilities and management study, cattle of known ancestry were highly desirable. This was the primary reason for using the cattle from Armour and Company. Originally, all cattle were to be obtained from Armour. However, this was not possible and cattle from another source (Group Two) were added.

Group One cattle (Armour) were out of Hereford dams and sired by Armour and Company's B.C.I. bulls. The cows were bred artificially to either an Angus, Polled Hereford, Hereford, Red Poll, or Shorthorn bull through two heat periods and after that they were exposed to Angus bulls on pasture. One of the Hereford bulls (H005) was an Armour Superior Sire; his offspring were used as a control group in this test. Thus, three sire groups of cattle from Armour were used: (1) steers and heifers sired by Armour Superior Sire H005; (2) steers and heifers sired by other Armour performance-tested bulls; and, (3) steers and heifers sired by Angus "clean-up" bulls.

The 64 head of steers from a commercial producer in Arkansas were Angus and Angus-Hereford cross steers.

Allocation to lots

Cattle were allotted at random to all fourteen lots. An equal number was assigned to each lot from each of seven different groups of cattle: (1) commercial steers from Arkansas, (2) steers by Armour Superior Sire H005, (3) heifers by Armour Superior Sire H005, (4) steers by other Armour performance-tested sires, (5) heifers by other Armour performance-tested sires, (6) steers by Armour Angus clean-up bulls, (7) heifers by Armour Angus clean-up bulls.

Care and treatment upon arrival

Feed upon arrival was grass hay for one day only. After that, corn silage and protein supplement comprised the ration. Within three days, cattle were on a full feed of silage.

Soluble aureomycin and vitamin A were added to the water supply at the rate of 100 milligrams and 1000

international units per gallon respectively. Electrolytes were also provided in accordance with the recommendation of the supplier.

Ten days after the cattle arrived, they were vaccinated for IBR, PI^3, and Pasturella bacterin. They had been vaccinated for malignant edema and blackleg before arrival. All calves were tattooed and ear-tagged prior to the start of the official test and horned calves were de-horned.

Sickness and death loss

No major sickness or disease occurred after the cattle arrived or anytime during the test. Only two head of cattle died: one from chronic bloat and one from bleeding following de-horning. The mortality rate was only 0.4 percent.

General feeding plan

All cattle were fed alike according to appetite. They were fed only once a day, usually early in the morning. The intent was to always have some feed before the cattle. Daily feed consumption records were kept for each lot. A self-unloading truck equipped with a batch mixer and electronic load cells was used to weigh, mix, and deliver feed to the bunks.

During the 140-day official winter test, all cattle were fed a finishing ration of ground high-moisture corn, corn silage, and protein supplement. The percentage of the total of each ingredient was 56 percent grain, 35 percent corn silage, and 9 percent supplement. The composition of feeds used was obtained at 30-day intervals during the test.

The protein supplement was mixed by the Agricultural Experiment Station feed mill according to a formula recommended by the Animal Husbandry Department. The composition of the supplement fed was as follows:

Protein Supplement

15% dehydrated alfalfa
45% soybean oil meal
15% ground shelled corn
25% urea premix
- 28.30% urea (281)
- 32.65% limestone
- 13.06% dicalcium phosphate
- 25.03% trace mineral salt

Diethylstilbestrol - 5 mg. per pound
Vitamin A - 12,500 I.U. per pound
Aureomycin - 37.5 mg. per pound

Beef tallow was added at the rate of 40 pounds per ton to aid in pelleting.

Pre-official test

During the period from arrival of the cattle until the beginning of the official test on Jan. 9, 1968, a growing ration of corn silage and protein supplement was fed at a ratio of 25 to 1.

Cattle Performance-Winter Test Period

The official winter test period was 140 days in length beginning Jan. 9, 1968, and ending May 28, 1968. Three hundred eighty cattle were fed in the outside lots and 48 were fed in the confinement barn. The number of head per outside lot varied from 20 to 80. Each confinement barn lot had 16 head. All cattle in the outside lots had approximately 200 square feet of lot space per head as compared to 29 square feet per head for the cattle in confinement. Some outside lot cattle had one linear foot of bunk space per head; others had two linear feet per head. The response of cattle to facilities is shown in Table 2.

Performance comparison by lots

Very little difference in performance was exhibited by cattle in the various outside lots. Daily gain ranged from 2.71 to 2.88 lbs. per day and feed per hundredweight gain ranged from 1019 lbs. to 1076 lbs. Even though the difference in feed efficiency seems significant there was no consistency from lot to lot which could be attributed to facilities.

Cattle in the lots with mounds did remain cleaner and dryer during extremely wet muddy periods. However, this did not seem to improve their performance. Cattle in Lot 1 made use of the shed on raw, windy days, when snow was blowing or when a cold rain was falling. They stayed outside of the barn most of the time.

As can be seen in Table 3, the average daily gain of cattle fed in confinement was not significantly different from those cattle fed in outside lots. The feed required per hundredweight gain was about 3% less for the cattle in the confinement barn.

The advantages of confinement finishing of cattle noted by researchers included these: (1) less labor was required; (2) manure collection and disposal were controlled; hence pollution due to run-off was minimized; (3) confinement cattle became more gentle than outside lot cattle; (4) confinement cattle were observed more easily by the feeder; (5) cattle coats carried practically no dung, therefore they were presentable for marketing at any time.

Slotted floor comparison

Table 4 gives a comparison of the three confinement pens. In this test there was practically no difference in the average daily gain of cattle on varying proportions of slotted floor. However, cattle in lot 8 (1/3 floor area

TABLE 2

EFFECT OF FACILITIES ON CATTLE PERFORMANCE
Jan. 9, 1968 - May 28, 1968 (140 days)

Lot No.	No. Head	Lot Characteristics	Bunk Space/ Steer (ft.)	A.D.G.	Feed Fed/ Cwt. Gain[1]
Outside lots:[2]					
1	80	Shed, 12' concrete bunk pad, and 15' concrete shed apron	1	2.84	1019
2A	20	12' concrete pad and 24' lime-covered area	2	2.87	1044
2B	40	12' concrete pad and 24' lime-covered area	1	2.82	1049
3A	20	27' concrete pad with 3/4 inch per foot slope	2	2.82	1065
3B	40	27' concrete pad with 3/4 inch per foot slope	1	2.88	1027
4A	20	12' concrete pad and lime-covered mound	2	2.82	1048
4B	40	12' concrete pad and lime-covered mound	1	2.80	1049
5A	20	12' concrete pad and dirt lot	2	2.72	1076
5B	40	12' concrete pad and dirt lot	1	2.79	1055
6A	20	2' concrete pad and dirt lot	2	2.85	1014
6B	40	2' concrete pad and dirt lot	1	2.71	1057
Confinement barn:[3]					
8	16	Slotted floor - 1/3 area	1	2.82	990
9	16	Slotted floor - 2/3 area	1	2.85	1006
10	16	Slotted floor - 3/3 area	1	2.83	1030

[1]Pounds expressed on 90% dry matter basis.
[2]All outside lots provided 200 square feet per head.
[3]All confinement barn lots provided 29 square feet per head.

TABLE 3

CATTLE PERFORMANCE - OUTSIDE LOT CATTLE vs. CONFINEMENT BARN CATTLE
Jan. 9, 1968 - May 28, 1968 (140 days)

	A.D.G.	Feed Fed/ Cwt. Gain[1]
Outside cattle[2]	2.81	1042
Confinement cattle[3]	2.84	1009
Differences	.03[4]	33

[1]Pounds expressed on 90% dry matter basis.
[2]Lots 1, 2A, 2B, 3A, 3B, 4A, 5A, 5B, 6A, and 6B.
[3]Lots 8, 9, and 10.
[4]No significant difference.

slotted) gained 100 lbs. on 40 lbs. less feed than those in lot 10 (floor area completely slotted).

Cattle in all confinement lots were relatively clean as compared to cattle in outside lots. The cattle on the completely slotted floor remained slightly cleaner throughout the test than those on either 2/3 or 1/3 slotted floors. When cattle were moved from the open lots to the confinement barn at the start of the official test, a mixture of dung and mud in appreciable amounts was clinging to their coats. This disappeared first from the cattle on total slots, next from cattle on 2/3 slots, and last from cattle on 1/3 slots.

TABLE 4

CATTLE PERFORMANCE - ON SLOTTED FLOORS
Jan. 9, 1968 - May 28, 1968 (140 days)

Lot No.	Slotted Floor	A.D.G.	Feed Fed/ Cwt. Gain[2]
8	1/3 slotted	2.82	990
9	2/3 slotted	2.85	1006
10	3/3 slotted	2.83	1030

[1]Pounds expressed on 90% dry matter basis.
[2]No significant differences in gain due to lots.

Bunk space comparison

A comparison of bunk space per head was made. Cattle had either one or two feet of bunk space per head. No difference was seen in average daily gain. However, there was a small advantage in pounds of feed per hundredweight gain for the cattle that had two feet of bunk space. Table 5 gives the bunk space results:

TABLE 5

CATTLE PERFORMANCE -- BUNK SPACE COMPARISON
Jan. 9, 1968 - May 28, 1968 (140 days)

Bunk Space/ Head	A.D.G.	Feed Fed/ Cwt. Gain[1]
1 foot	2.81	1049
2 feet	2.82	1039

[1]Pounds expressed on 90% dry matter basis.

Similar results were obtained in the preceding year's test when comparing one and two feet of bunk space. Some advantage was shown with both one and two feet of bunk space over only 9" when feeding a full feed of silage. Thus, one foot of bunk space seemed adequate for this type of finishing ration.

Comparison by source

A comparison of the average daily gain of cattle sired by different bulls is shown in Table 6.

TABLE 6

CATTLE PERFORMANCE - COMPARISON BY SOURCE
Jan. 9, 1968 - May 28, 1968 (140 days)

Source	No. Head	A.D.G.
By Armour Superior Sire H005	90	2.96
By Armour known sires	189	2.83
Average		2.87
By pasture bulls	86	2.59
Difference: Performance tested over non-performance tested		.28

Armour Superior Sire H005 was a performance tested bull that had also been progeny tested and met strict standards for rate and efficiency of gain and carcass desirability. Therefore, H005 was classified as a superior sire by the Armour B.C.I. Station. Armour known sires were bulls that had been performance tested and were, at that time, being progeny tested. The Armour pasture bulls were neither performance nor progeny tested.

The performance tested bulls sired faster gaining calves. The steers and heifers by the performance tested sires (Armour Superior Sire H005 and Armour known sires) gained 2.87 lbs. per day compared to 2.59 lbs. per day gained by the cattle sired by the pasture bulls which had not been performance tested. Furthermore, the cattle by Armour Superior Sire H005 gained. 13 lbs. per day more than the cattle by the Armour known sires. As one might expect, the average daily gain for all steers on test (2.92 lbs. per day) was significantly greater (P .001) than for all heifers on test (2.52 lbs. per day).

Marketing - winter test period

The 383 head of Armour cattle were fed on a contract basis for Armour by the University. They were slaughtered by Armour at their St. Joseph, Mo., plant. About 62% of the cattle made Choice grade.

Out of the 381 head of Armour cattle that were slaughtered,[3] only twelve had bruised carcasses. This was 3.15% and was unusually low. This can be partly attributed to the improved loading facilities shown.

The 64 head of steers from the commercial producer were used for the test from May 28 to July 23, 1968.

[3] Only 381 head were sold since two head died.

Cattle Performance-Summer Test Period

May 28, 1968 - July 23, 1968

Sixty head of the cattle from the commercial producer source were randomly reallotted to outside lots 5B and 6B and to confinement barn lot 9 on May 28. The cattle were continued on the finishing ration of ground, high-moisture corn, corn silage, and protein supplement for the 56-day test period. The response of cattle is shown in Table 7.

Cattle in the outside lot with shade and in the confinement barn gained faster and more efficiently than cattle in the non-shaded outside lot. Furthermore, the cattle in lot 5B, the shaded outside lot, gained faster and required less feed per hundredweight gain than those in lot 9 in the confinement barn.

The average daily gains of these cattle were substantially lower than during the preceding 140 day test period. Three reasons for this included: (1) the character of the gain (more fat), (2) source of cattle, and (3) the hot, humid weather.

Marketing

The cattle were marketed on a grade and yield basis on July 31, 1968. Seventy-three percent of the carcasses graded USDA Choice. Only two carcasses (3.13%) were bruised.

TABLE 7

EFFECT OF FACILITIES ON CATTLE PERFORMANCE
May 28, 1968 - July 23, 1968 (56 days)

Lot No.	No. Head	Lot Characteristics	A.D.G.	Feed Fed/ Cwt. Gain[1]
5B	20	12' concrete pad, sheet metal shade, and dirt lot	2.21	1063
6B	20	6' concrete pad and dirt lot	1.80	1277
9	20	Confinement: slotted floor - 2/3 area	1.96	1111

[1] Pounds expressed on 90% dry matter basis.

REPORT OF THE FOURTH TEST

The 1968-69 test was the fourth in this cattle feedlot facilities and management study. All cattle were handled under good systems of management in both the outside lots and the confinement barn.

Five hundred twenty Good and Choice grade, steer calves averaging 450 lbs. were obtained in October and November 1968. By culling the extremely large and extremely small cattle prior to the official test, 480 head of uniform cattle were used in this year's study. The cattle were divided into two different groups for the winter test period, Jan. 21 to May 1, 1969. Group One was fed a growing ration of corn silage and supplement. Group Two was fed a finishing ration of high-moisture corn, corn silage, and supplement. Group One cattle were changed over to a finishing ration for the summer test period May 22 to Aug. 28, 1969. Group Two cattle were sold in July 1969. All cattle within each group were handled and fed alike so that the difference in performance could be attributed to facilities.

Source of cattle

The cattle were obtained from three sources which represented both crossbreds and purebreds as follows: (1) 119 steers were obtained from Missouri cattle breeders (five groups of 20 and one group of 19). These groups represented Angus, Hereford, Polled Hereford, Angus-Hereford crosses, and Charolais-Angus crosses; (2) 136 head of Hereford steer calves were purchased from near Brady, Tex., through the Interstate Producers Livestock Association. These cattle came from ranches known for producing good cattle; (3) 267 steers were purchased on order through the Producers Livestock Marketing Association of Southwest Missouri Markets. These cattle represented many herds and breed combinations.

Treatment upon arrival

The cattle were delivered to the feedlot in various groups from Oct. 17 through Nov. 21, 1968. Feed for the first day was grass hay. Starting on the second day, the ration consisted of corn silage and a protein supplement. Most of the cattle were on a full feed within three to seven days.

In contrast to the preceding test, vitamin A, antibiotics, and electrolytes were not forced through the water system for the cattle upon arrival. However, after a few days at the feedlot, the first group of cattle became sick and after that the water was medicated for all incoming cattle.

The cattle were vaccinated for IBR (red nose), leptospirosis, and blackleg within three weeks after arrival, depending upon their condition. A few calves were also dehorned.

Identification of cattle

All of the cattle were branded with a hot iron and tattooed. Before applying the hot iron, hair was clipped from the area to be branded. The brand was placed on the rump for ease of identification when working the cattle. Numbering was based on an angle system as shown in figure 4. Three irons were used with this system: (1) a 4 inch 90• angle iron; (2) a 4 inch bar; and (3) a 0.

Hot iron branding should be done before winter coats are grown and dirt and dung mat the hair.

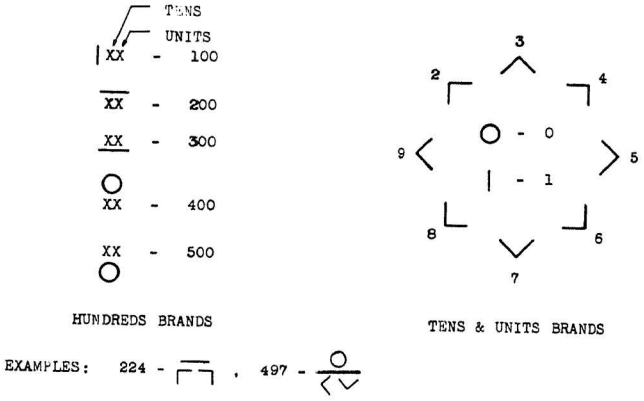


Fig. 4—

Allocation to lots

Thirty-two steers, the extremely large and extremely small ones, were culled and sold prior to the start of the official test.

Three hundred and sixty head were assigned at random on Jan. 2, 1969, to lots 2A, 2B, 4A, 4B, 5A, 5B, 6A, 8, 9, and 10. The range in average weight was from 558 to 580 lbs.

The remaining 119 head, the breeders cattle, were fed together in lot 1. Later, 60 head were removed because of excessive mud in lot 1; 30 head were put in 3A and 30 in 3B. These cattle were handled as nearly alike as possible so their performance in the summer test to follow would more nearly reflect the effects of the different facilities.

Sickness and death loss

Ten head died prior to the start of the official test. Cause of death of the first seven was shipping fever or shipping fever-pneumonia complex. The other three died of Listeriosis (circling disease).

One steer died after the start of the winter test; the cause was Listeriosis. The total death loss was 2.1 percent, the highest for any of these tests.

All of the cattle were under the supervision of the School of Veterinary Medicine. The sickness problem was

corrected by increasing the level of antibiotic in the protein supplement from 7 lbs. of aureomycin premix per ton of supplement to 70 lbs. per ton. This increase allowed a level of approximately 700 mg. of aureomycin per head per day. After two weeks the level of aureomycin was returned to 7 lbs. of premix per ton of supplement.

General feeding plan

The cattle were fed once each day in winter. The amount fed was regulated according to appetite. Starting on July 18, 1969, during the summer test, the cattle were fed twice daily, early morning and late afternoon. It was intended that the cattle have some feed at all times and that the amount refused would be the same, relatively, in all lots. Feed was weighed, mixed, and delivered with an auger truck equipped with a batch mixer and electronic load cells. Total feed fed was recorded on a per lot basis.

Pre-official test

From arrival until the beginning of the official test, all cattle were fed a growing ration which consisted of 20 parts corn silage by weight to one part supplement.[1]

The average daily gain was 1.23 lbs. per day for all of the cattle during the pre-test conditioning period from Dec. 20, 1968, to Jan. 21, 1969 (start of the official winter test period). Data were not available for computing average daily gain prior to this preliminary (or pretest) period.

[2] See page 8 for protein supplement composition.

Cattle Performance-Winter Test Period

The official test period was 100 days in length; it began on Jan. 21 and ended on May 1, 1969. Three hundred twenty steers (Group One) received the same growing ration of 20 parts corn silage to one part supplement from Jan. 21 to April 18 during the official winter test. Beginning April 18, or during the last two weeks of this test period, the cattle ration was changed over gradually to a finishing ration. the changeover was only partially completed at the end of the winter test on May 1, 1969.

One hundred sixty steers (Group Two) were fed a finishing ration of 35% corn silage, 56% ground high-moisture corn, and 9% supplement during the test period, Jan. 21, 1969, to May 1, 1969.

There was a great deal of snow and rain during the winter test and the lots got very muddy. Richard Scharnhorst, in charge of feeding the cattle, stated, "The lots have been sloppy for a longer period of time than any other time since the feedlot was begun in 1965." The lots were muddy at the beginning of the test and for most of the 100-day test period. Table 8 shows the precipitation and temperature for most of the test.

Performance comparison by lots (Group One)

Lots 2A, 2B, 5A, 5B, and 6A contained 40 head each. This allowed each steer an average of 200 square feet of lot space and one linear foot of bunk space. The cattle were fed a growing ration which consisted of corn silage and supplement. Gains were relatively good in spite of the bad weather. The data are given in table 9.

TABLE 8

WEATHER DATA

Weather Event	1969 and Departure from Normal							
	January		February		March		April	
	1969	Dept.	1969	Dept.	1969	Dept.	1969	Dept.
Precipitation (inches)	3.61[2]	1.63[2]	1.99	- .05	2.10	- .98	5.03	.72
Average temperature (°F)	31.50	- .30	34.00	- .70	36.90	- 5.70	55.90	1.00
Possible sunshine (percent)	37.00	-13.00	41.00	-11.00	69.00	16.00	66.00	7.00

[1] January 21 to 31

[2] Includes all of January

TABLE 9

EFFECT OF FACILITIES ON CATTLE PERFORMANCE - (GROWING RATION)
Jan. 21, 1969 to May 1, 1969 (100 days)

Lot No.	No. Cattle	Lot Characteristics	A.D.G.	Feed Fed cwt.[1]
2A	40	Feed bunk covered; 12' pad and lime-covered area	1.49	1146
2B	40	Feed unprotected; 12' pad and lime-covered area	1.54	1099
5A	40	Feed bunk covered; area unrestricted	1.53	1126
5B	40	Feed unprotected; shade in lot fenced out during winter	1.70	1017
6A	40	8' wide concrete pad	1.49	1153

[1]Pounds expressed on 90% dry matter basis (air dry feed).

The range in average daily gain of cattle was from 1.49 to 1.70 lbs. per day for an average difference of 21 lbs. per steer for the test. Feed conversion for Group One lots ranged from 1017 to 1153 lbs. of feed per hundredweight gain, a difference of 136 lbs.

Bunk cover comparison

The feed bunks in lot 2A and 5A were covered with canvas. The covers appeared to depress performance as indicated in Table 10.

TABLE 10

CATTLE PERFORMANCE - COVERED vs. NON-CONVERED BUNKS
Jan. 21, 1969 - May 1, 1969 (100 days)

Bunk Status	A.D.G.	Feed Fed/ Cwt. Gain[1]
Covered[2]	1.51	1136
Non-Covered[3]	1.62[4]	1058
Difference	.11 lb.	78 lbs.

[1]Pounds expressed on 90% dry matter basis.

[2]Includes lots 2A and 5A

[3]Includes lots 2B and 5B

[4]The cattle in outside lots with unprotected feed bunks gained significantly faster (P<.05) than outside lots cattle with covered bunks.

The bunk covers had no significant effect upon the amount of feed consumed; therefore, the differences in performance must have been due to differences in energy utilization. Furthermore, the differences in cattle performance as indicated in Table 10 may have been caused by the differences in lot design rather than by the bunk covers. It was noticed after the original design of the test that the "B" lots were not exact replicas of the "A" lots, since the "A" lots contained a cross fence in their upper portion. Consequently, the mud in traffic patterns in the "A" lots was deeper and may have caused more energy to be wasted as the cattle moved from the feed bunk to their resting area below the cross fence. During cold wet weather, the cattle in the "A" lots would use the feed bunk covers for protection. Consequently, more manure was deposited in the "A" lot feed bunks than in the "B" lot feed bunks.

Comparison by source — Missouri Breeders' Cattle

Groups of cattle from Missouri cattlemen were handled as nearly alike as possible in lots 1, 3A, and 3B. Lot 1 contained 60 head and lots 3A and 3B had 30 head each. The various breeder groups shall be referred to as Groups A, B, C, D, E, and F for purposes of discussion. Table 11 shows the performances of the various groups and their comparison with the other cattle that were fed the same growing ration.

TABLE 11

PERFORMANCE COMPARISON BY SOURCE -- MISSOURI BREEDERS' CATTLE[1]
Jan. 21, 1969 - May 1, 1969 (100 days)

Source	A.D.G. #
Group A	2.05
Group B	1.98
Group C	1.91
Group D	1.89
Group E	1.83
Group F	1.69
Average - Groups of Missouri Breeder Cattle	1.89
Average - Other (Missouri & Texas) Cattle	1.68

[1]These breeders have been participating in the Missouri Performance Testing Program.

The Missouri Breeders' Cattle out-performed all other cattle fed the growing ration. Although the test was not designed to compare the Missouri Breeders Cattle with the other cattle, the excellent and nearly consistent gains made by the breeder groups indicated their superiority during the winter test. This superiority may have been caused by several factors including (1) higher quality, larger-framed cattle and (2) less stress in shipment to the feed lot.

TABLE 12

EFFECT OF FACILITIES ON CATTLE PERFORMANCE -- (FINISHING RATION)
Jan. 21, 1969 - May 1, 1969 (100 days)

Lot	No. Head	Lot Characteristics	Area/Steer Sq. Ft.	A.D.G.	Feed Fed Cwt. Gain[1]
Outside lots:					
4A	39	12' concrete pad and lime-covered area	42	1.70	1074
4B	40	12' concrete pad, lime-covered mound and dirt lot	200	2.12	896
6B	32	6' concrete pad and dirt lot	250	2.37	888
Confinement barn:					
8	16	slotted floor-1/3 of area	29	2.63	799
9	16	slotted floor-2/3 of area	29	2.77	716
10	16	slotted floor-3/3 of area	29	2.70	733

[1]Pounds expressed on 90% dry matter basis.

Performance comparison by lots (Group Two)

One hundred sixty steers were fed a finishing ration which consisted of corn silage, high-moisture corn, and supplement. Three outside lots (4A, 4B, and 6B) contained a total of 111 head and the three confinement pens contained 16 head each. One steer out of lot 4A died March 6 from *Listeriosis.* Cattle performance on the finishing ration differed greatly as shown in Table 12.

As stated previously, the cattle in lot 4A were confined to the feed bunk pad and the usable portion of the mound. Under this stress, the mound broke down and the lot was in very bad condition by the end of the test.

The cattle in lot 4A consumed less feed, gained less, and required more feed per hundredweight gain. Table 13 shows the amount of air dry feed (90% dry matter basis) fed per steer for the entire winter finishing period.

The feed bunk in lot 4A was covered as compared to no cover in lot 4B. However, this effect in itself could not be measured since the cattle in 4A were also restricted to the mound.

The cattle in the confinement barn out-gained the outside lot cattle by .67 lbs. per day on the finishing ration. Table 14 gives this comparison which was significant at the $P<.001$ level.

The advantage of .67 lb. and 207 lbs. less feed per hundred weight gain indicates that the confinement barn had some distinct advantages during the 1968-69 winter over outside lots for finishing cattle.

The exclusion of the performance data by cattle in lot 4A reduces these differences yet the cattle performances in

TABLE 13

DAILY FEED CONSUMPTION PER HEAD
Jan. 21, 1969 - May 1, 1959 (100 days)

Lot #	Lbs. Feed Fed/Day[1]
4A	18.29
4B	19.04
6B	21.06
8	21.01
9	19.83
10	19.78

[1]Pounds expressed on 90% dry matter basis.

TABLE 14

CATTLE PERFORMANCE
CONFINEMENT BARN vs. OUTSIDE LOTS
Jan. 21, 1969 - May 1, 1969 (100 days)

	A.D.G.	Feed Fed/ Cwt. Gain[1]
Outside Lots[2]	2.04	956
Confinement Barn[3]	2.71	749
Difference	.67 lb.[4]	207 lb.

[1]Pounds expressed on 90% dry matter basis.

[2]Includes lots 4A, 4B, and 6B.

[3]Includes Pens 8, 9 and 10.

[4]Significant difference at P .001 level.

the confinement barn remain significantly greater (P<.001). See Table 15.

TABLE 15

CATTLE PERFORMANCE
LOTS 4B AND 6B vs. CONFINEMENT BARN
Jan. 21, 1969 - May 1, 1969 (100 days)

Lot(s)	A.D.G. #	Feed Fed/ Cwt. Gain[1]
4B and 6B	2.23	892
Confinement	2.71	749
Difference	.48[2]	143

[1]Pounds expressed on 90% dry matter Basis.

[2]Significant difference at P<.001 level.

Slotted floor comparison

Cattle daily gains and feed conversion were extremely good within all lots in confinement. There was a slight difference in cattle performance between lots; however, the differences were not indicative of the degree of slotted floor as can be seen in Table 16.

TABLE 16

CATTLE PERFORMANCE - ON SLOTTED FLOORS

Lot #	Slotted Floor	A.D.G.	Feed Fed/ Cwt. Gain[2]
8	1/3 Slotted	2.63	799
9	2/3 Slotted	2.77	716
10	3/3 Slotted	2.70	733

[1]No significant differences in gain due to lots.

[2]Pounds expressed on 90% dry matter basis.

The reason for the superior performance of those cattle in lot 9 was unidentified. The beginning and ending cattle weights were nearly equal in all lots, hence, weight did not appear to be a factor. The center location of lot 9 may have been a factor affecting performance. Most likely, the superior performance of the cattle in lot 9 was due to the superiority of the individuals within that lot.

Marketing - winter test period

The intent was to market the cattle when the majority would grade high Good and low Choice. The official winter test was ended on May 2 in order to allow sufficient time for lot cleaning and other preparations before the summer test began for the growing ration cattle (Group One). Originally, the winter test was to begin about mid--December. However, the test was delayed by a lag in the construction of an environmentally controlled barn which was never completed during the test period. Consequently, the Group Two cattle were not ready to market on May 1.

The Group Two cattle (159 head) were shipped to Independent Packing Company at St. Louis, Mo., on July 1 and slaughtered July 2 on a grade and yield basis. The cattle loaded without trouble except for one steer. Only seven carcasses (4.4%) were reported as bruised, and probably all except one carcass (0.6%) was bruised after the cattle left the feedlot.

Cattle Performance-Summer Test Period

The official test period was 98 days in length, beginning May 22, 1969, and ending Aug. 28, 1969. The 320 head of cattle on the growing ration during the winter period (Group One) were assigned at random to lots. An interim period of 21 days between the end of the winter period and the start of the summer period allowed time for lot cleaning and other preparations. All cattle were on full feed at the start of the official summer test period.

Performance comparison by lots

All 320 cattle were fed a finishing ration of corn silage, high-moisture corn, and supplement. One hundred ninety-two head were in outside lots 2B, 4B, 5A, 5B, and 6B with 200 square feet per steer; the 80 head in outside lots 2A and 4A were restricted to 50 square feet per steer; and 48 cattle were in the confinement barn lots 8, 9, and 10 with 29 square feet per steer. The response of cattle to facilities

is shown in Table 17. Note that two steers were removed from the test due to diphtheria on July 24, 1969.

The cattle in the confinement barn lots gained .37 lb. per day faster and used 82 lbs. less feed per hundredweight gain than all cattle in the outside lots. Excluding the performance data of the cattle confined in outside lots 2A and 4A only slightly reduced these differences as shown in Table 18. The average daily gain of the confinement barn cattle remains significantly greater ($P<.01$) than the outside lot cattle with 200 square feet allotted each steer.

TABLE 17

EFFECT OF FACILITIES ON CATTLE PERFORMANCE
May 22, 1969 - Aug. 28, 1969 (98 days)

Lot No.	No. Head	Lot Characteristics	Area/steer Sq. Ft.	A.D.G.	Feed Fed/ Cwt. Gain[1]
Outside lots:					
2A	39	12' concrete pad and lime-covered area	50	2.38	814
4A	40	12' concrete pad and lime-covered mound	50	2.25	893
Averages:	Restricted area				
	79		50	2.32	854
2B	39	12' concrete pad and lime-covered area	200	2.40	825
4B	40	12' concrete pad lime-covered mound and dirt lot	200	2.45	806
5A	40	12' concrete pad and dirt lot	200	2.42	829
5B	40	12' concrete pad dirt lot, and 21 sq. ft. of shade per steer	200	2.61	806
6B	32	6' concrete pad and dirt lot	250	2.51	818
Averages:	Non-restricted area				
	191			2.48	817
Averages:	All outside lots				
	270			2.43	827
Confinement barn:					
8	16	Slotted floor- 1/3 of area	29	2.79	717
9	16	Slotted floor- 2/3 of area	29	3.01	723
10	16	Slotted floor- 3/3 of area	29	2.58	795
Averages:	Confinement barn				
	48			2.80	745

[1]Pounds expressed on a 90% dry matter basis (air dry feed).

TABLE 18

CATTLE PERFORMANCE - OUTSIDE LOT CATTLE vs. CONFINEMENT BARN CATTLE

	No. Head	Sq. Ft.	A.D.G.	Feed Fed/ Cwt. Gain[1]
Outside lots[2]	191	200	2.48	817
Confinement barn[3]	48	29	2.80	745
Difference			.32[4]	72

[1]Pounds expressed on 90% dry matter basis

[2]Lots 2B, 4B, 5A, and 6B

[3]Lots 8, 9 and 10

[4]Difference in average daily gain between outside lot cattle and confinement barn cattle was significant at P .01 level.

Cattle confined to 50 square feet per steer in outside lots made respectable gains of 2.32 lbs. per day, but they were significantly lower (P<.05) than the 2.48 lbs. per day gained by cattle fed in outside lots with 200 square feet per steer. Furthermore, the outside lot cattle with 200 square feet of area used 40 lbs. less feed to make 100 lbs. of gain than the outside lot confined cattle. Refer to Table 19.

Cattle finished in an outside lot with shade provided gained faster and required less feed per hundred weight gain than cattle in outside lots which did not have shade. See Table 20 for the results.

Table 21 presents the comparison of slotted floors in the confinement barn. Gains and feed conversion by these cattle were excellent in all lots. Although the variation in average daily gain was greater during the summer test period than during the winter test period, the differences in average daily gains among the confinement barn lots were

TABLE 19

CATTLE PERFORMANCE -- OUTSIDE LOTS WITH 200 SQUARE FEET PER HEAD vs. OUTSIDE LOTS WITH 50 SQUARE FEET PER HEAD

Outside Lot Area/Head	A.D.G.	Feed Fed/ Cwt. Gain[1]
50 sq. ft.	2.32	854
200 sq. ft.	2.48	817
Difference	.16[2]	37

[1]Pounds expressed on 90% dry matter basis.

[2]Significant difference at P<.05 level.

TABLE 20

CATTLE PERFORMANCE - SHADE vs. NO SHADE IN OUTSIDE LOTS
May 22, 1969 - Aug. 28, 1969 (98 days)

	No. Head	A.D.G.	Feed Fed/ Cwt. Gain[1]
Shade[2]	40	2.61	806
No shade[3]	151	2.45	820
Difference		.16[4]	14

[1]Pounds expressed on 90% dry matter basis.

[2]Lot 5B

[3]Lots 2B, 4B, 5A, 6B.

[4]Significant at P<.05 level. These cattle had 200 square feet of space per steer.

TABLE 21

CATTLE PERFORMANCE - CONFINEMENT BARN CATTLE
May 22, 1969 - Aug. 28, 1969 (98 days)

Lot No.	No. Head	Lot Characteristics	Area Sq. Ft.	A.D.G.[1]	Feed Fed/ Cwt. Gain[2]
8	16	Slotted floor - 1/3 of area	29	2.79	717
9	16	Slotted floor - 2/3 of area	29	3.01	723
10	16	Slotted floor - 3/3 of area	29	2.58	795
		Averages		2.80	745

[1]No significant differences.

[2]Pounds expressed on 90% dry matter basis.

not statistically significant. However, lot 9 (2/3 slotted floor) was slightly superior to the other lots. Even so, this trend may have been due to the center location of lot 9 in the confinement building rather than the relative proportion of slotted floor.

Comparison by source - Missouri Breeders' Cattle

The six groups of cattle from Missouri herds, handled as nearly alike as possible during the winter test period, were randomly allotted to all experimental facility treatments for the summer test period. In Table 22, the various breeder groups are identified by letters A, B, C, D, E, and F, corresponding to the group letter used in the winter test period comparison by sources. From the results, the Missouri cattle did not maintain their advantage demonstrated during the winter test period. The results also show that groups B and F were significantly lower in daily gains ($P<.05$) than the other (Missouri and Texas) cattle. In fact, if groups B and F are excluded from the Missouri Breeders cattle data, the average daily gains of groups A, C, D, and E from Missouri Breeders are higher than the other (Missouri and Texas) cattle.

TABLE 22

COMPARISON BY SOURCE - MISSOURI BREEDERS' CATTLE
May 22, 1969 - Aug. 28, 1969 (97 days)

Source	A.D.G.
Group A	2.47
Group B	2.22[1]
Group C	2.57
Group D	2.66
Group E	2.66
Group F	2.20[1]
Average-Groups of Missouri Breeders Cattle	2.46
Average-Other (Missouri & Texas) Cattle	2.50

[1]Groups B and F were significantly lower in average daily gain ($P<.05$) than the average of Missouri Breeders cattle and the average of the other (Missouri and Texas) cattle.

Comparison by carcass grades

U.S.D.A. yield grades and U.S.D.A. quality grades were obtained on all carcasses. U.S.D.A. yield grades for beef carcasses include U.S.D.A. numbers 1, 2, 3, 4, and 5. U.S.D.A. 1 is the most desirable carcass with a relatively high yield of trimmed retial cuts, while U.S.D.A. 5 is the least desirable from the standpoint of cutability. For ease of statistical comparison of the test results, U.S.D.A. quality grades for beef carcasses were numerically designated as follows: U.S.D.A. quality grades 9, 10, 11 (low, average and high Good respectively) and 12, 13, 14 (low, average and high Choice, respectively).

The variation among treatment lots was not significant for either yield grades (2.92 to 3.31) or quality grades (11.06 to 11.68). As one might expect, the variation in U.S.D.A. quality grades among sources of cattle (10.50 to 11.84) was significant at the $P<.05$ level. Moreover, the variation in U.S.D.A. yield grades among sources of cattle (1.89 to 3.35) was significant at the $P<.005$ level. These differences verify that inherited or breeding factors have greater influence on both carcass quality and yield grades than does the environment.

Marketing - summer test period

Similar to the winter test period, the cattle were to be marketed when most of the cattle would grade high Good and low Choice. The official summer test period ended Aug. 28, 1969, when final weights were taken on all cattle.

On Sept. 4, 160 head of the cattle and on Sept. 5, 158 head of the cattle were shipped to Independent Packing Company in St. Louis, Mo. On both days, the cattle were marketed on a grade and yield basis. After chilling, data were obtained on all carcasses (refer to the comparison by carcass grades for details). Twenty and one-half carcasses (6.4%) were reported bruised, nine of the Sept. 4 group and eleven and one-half of the Sept. 5 group. Identifying the cause for the bruises is difficult as the cattle loaded without trouble. The handling of the cattle for paint-branding identification on Sept. 3, the day prior to shipment, and the handling of some cattle for papain injection at the slaughter plant on the second day are both possible explanations.

Summary

The cattle feedlot facilities and management study at the University of Missouri Weldon Spring Center has evaluated various facilities and equipment since the fall of 1965. During the first and second annual tests, the varied outside lot facilities and equipment were tested. Results of these years' work were reported in Missouri Agricultural Experiment Station Special Reports 77 and 97.

As the study progressed, the feedlot facilties were improved on the basis of findings and more equipment added for evaluation and comparison. Prior to the third test, the open-fronted confinement barn containing three pens, each varying in proportion of slotted floor, was constructed.

In the 1967-68 third test, 380 cattle were fed in outside lots and 48 were fed in the three confinement barn lots. The following 1968-69 fourth test utilized 480 head of cattle to evaluate the various outside lots and the confinement lots.

Performance data from the third and fourth tests in this facilities and management study substantiate the following summary of facilities' effects upon the performance of feedlot cattle.

The open-fronted confinement barn exhibited distinct advantages in rate and efficiency of gain over the outside lots for finishing cattle during seasons of adverse weather conditions. During the severe winter of 1969, the confinement barn cattle outgained the outside lot cattle by nearly .5 lb. per day on about 140 lbs. less feed per hundredweight gain. Similarly, during the hot and humid summer period of the fourth test, the confinement barn cattle gained .32 lb. per day faster and used 72 lbs. less per hundredweight gain than cattle in outside lots. On the other hand, during the relatively mild weather of the 1967-68 third test, the confinement barn facility had no advantage in rate of gain and only 3% lower feed efficiency than the outside lots for finishing cattle.

Several additional advantages of confinement finishing of cattle were observed in these tests: (1) less labor with confinement; (2) manure collection and disposal controlled, hence pollution due to runoff was minimized; (3) confinement cattle became more gentle than outside lot cattle; (4) confinement cattle were more easily observed by the feeder; and (5) cattle coats carried practically no dung, therefore they were presentable for marketing at any time.

To evaluate justifiable capital investment in confinement facilities, one must compare the advantage in daily gain and feed efficiency to the facility cost per head of capacity. In general, confinement facilities must be used for finishing heavy cattle on relatively high concentrate rations to obtain two and a half turns per year. Based on 350 days on feed, the .4 lb. average advantage of confinement cattle in daily gain would represent an additional 140 lbs. gain per head annually. The value of this extra weight gain in dollars and cents would equal the economical investment per head capacity in confinement facilities. Similar calculations could be used to value confinement facilities for improved feed conversion.

In both the third and fourth tests, no significant differences in cattle performance were observed among the confinement barn lots with varying proportions of slotted floors. Although the cost of the overhead structure will remain about the same for all three pens, the cost of the floor and pit will vary. Thus, the 1/3 slotted floor pen will cost less than the 2/3 and fully slotted pens and still give comparable performance.

Two hundred square feet of space per head in outside lots proved most satisfactory. When cattle were restricted to 50 square feet (or less) of space per head in outside lots, performance was depressed and limestone-covered mounds were stressed, thus requiring additional lot maintenance.

One linear foot of bunk space per head was proven adequate for feeding cattle a high moisture corn, corn silage, and protein supplement finishing ration in fenceline bunks.

In yet another comparison, cattle finished in an outside lot with shade provided gained significantly faster and required less feed per hundredweight gain than cattle in outside lots which did not have shade.

As one might expect, facilities demonstrated no effects on either carcass yield or quality grades of the cattle.

Areas in outside lots requiring maintenance included the following: (1) open shed floor, (2) edge of the concrete pads where they join dirt lots, (3) beneath the back rubber, (4) limestone covered areas which are severely stressed, (5) fences that are not protected by either an electrically charged wire or a crash board.

Observations regarding manure movement and handling were these: (1) cattle traffic is the primary mover of manure in open lots; an area six feet wide at the bunks is kept clean, (2) removal of manure from pits and from lots is a time-consuming and "smelly" job, (3) crust formed atop the manure in pits had to be broken up by back-flushing from the liquid manure wagon, (4) proper mixing of waste materials was important to prevent drawing off only the liquid portion.

Additional tests in this cattle feedlot facilities and management study are currently in progress to further test findings to date and to evaluate additions to the present facilities including a totally enclosed confinement barn.