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Philip Henderson

Larry Bitney

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UNIVERSITY OF NEBRASKA COLLEGE OF AGRICULTURE AND HOME ECONOMICS
EXTENSION SERVICE
AND U. S. DEPARTMENT OF AGRICULTURE COOPERATING
E. F. FROLIK, DEAN   J. L. ADAMS, DIRECTOR

Confinement Finishing of Hogs
Cost Comparisons

By

Philip A. Henderson and Larry L. Bitney[1]

INTRODUCTION

Confined hog production systems with automated feeding and watering systems and some degree of environment control are comparatively new in Nebraska. A study was made to determine capital requirements, labor requirements, and costs of production. This bulletin reports the information obtained and compares budgeted costs for several finishing systems.

Research at Wisconsin, Purdue, and by the Department of Agricultural Economics at Illinois indicates that feed required per pound of gain in environment-controlled units was not significantly different from that required in conventional confined units. Illinois economists concluded that differences in costs of production were primarily related to building, labor and equipment. Consequently, the main emphasis in Nebraska's study was placed on differences in labor requirements and on building and equipment costs.

A mail questionnaire was sent to swine producers using both the conventional confined system (open front shed with a feeding floor in front) and the newer, enclosed and automated confined systems. Replies were received from 30 producers using the enclosed environmentally-controlled systems and 92 using the conventional system.

The replies were classified according to size and pattern of marketing and visits were made to 32 farms to obtain information concerning time spent at routine daily chores as well as time required for other jobs essential to the swine finishing activity. A majority of the cooperators kept labor records for a week. These were used as a check against estimated labor requirements.

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[1] Agricultural Extension Economist (Farm Management); Assistant Agricultural Extension Economist.

Dimensions and other characteristics of buildings and equipment were obtained from the producers visited. This information and cost estimates obtained from the cooperators and agricultural engineers served as a basis for budgeting the building and equipment costs used in system comparisons.

Other costs were estimated on the basis of cost studies in other states and estimates of cooperating producers.

DESCRIPTION OF FACILITIES VISITED

Conventional systems consisted of an open shed with concrete floor and a concrete feeding floor in front of the shed. Basically, they were of two types: those with liquid manure disposal systems and those with solid manure disposal systems.

Nine of the 15 environment-controlled facilities visited were commercially made structures. All but one of these nine had been erected by someone other than the farmer. Four of the 15 had been built on the farm and 2 had been made by remodeling old buildings.

All conventional-solid manure facilities (7) and all but 3 of the 10 conventional-liquid manure facilities had been constructed on the farms as new buildings. The other three were remodeled old buildings.

Most environment-controlled buildings designed and built by commercial firms had been in use a very short time (Table 1). Those constructed on the farm had been in use a little longer but neither commercially fabricated nor farm constructed environment-controlled units had been in use as long as the conventional units visited.

Eleven of the environment-controlled units were divided into long narrow pens with partially slotted floors. Each pen contained about 60 square feet with about one-fourth of this area slotted.

Two of the other four environment-controlled units had partially slotted floors while the other two had completely slotted floors. None of the four were divided into smaller pens.

Table 1. Average length of time in use, by systems.

Type of system	Years of use
Environment-controlled	
Commercially designed and built	1.0
Farm built	1.8
Conventional	
Liquid manure disposal	4.7
Solid manure disposal	7.9

Nine of the 15 environment-controlled units used steel slats in their slotted floor area; three used wood; two concrete slats; and one used steel mesh.

CONSTRUCTION COSTS

To compare environment-controlled and conventional systems, costs of construction were budgeted for a standard unit of each type, defined as follows:

1. A farm built environment-controlled system, (hereafter referred to as EC-1).

Building - Wood frame construction

Center aisle, with long, narrow pens, about sixty square feet each with a partially slotted floor

Insulation and ventilation according to recommended standards[1]

Equipment - An automatic waterer in each pen

An automatic time interval feeding system complete with bulk feed tanks

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1/ Swine Equipment and Housing Needs. Extension Circular No. 64-731, University of Nebraska, Lincoln, Nebraska, 1964.

Manure disposal - Manure pits beneath the slotted portion of the floor, drained into a lagoon

2. A commercially designed and built environment-controlled system, (hereafter referred to as EC-2).

Building - Pre-fabricated metal

- Other characteristics are same as for farm built system in EC-1

Equipment - Same as for EC-1

Manure disposal - Same as for EC-1

3. A conventional system with liquid manure disposal.

Building - Pole-type shed open on one side

Concrete floor in building and a concrete feeding floor adjoining the open side of the building

Equipment - Automatic waterers located inside building

Self-feeders inside building

A bulk feed tank outside the building and lot, connected by augers to the self-feeders

Manure disposal - Lagoon adjacent to the feeding floor

All physical requirements used in designing the three systems with regard to animal space requirements, feeders, waterers, lagoon area, ventilation, and insulation are in accordance with standards stated in "Swine Equipment Plans and Housing Needs."2/

2/ Extension Circular No. 64-731 Swine Equipment Plans and Housing Needs, University of Nebraska, 1964.

Three sizes of systems were budgeted for comparison. Sizes, based on 200 pound hog capacity, were 107, 226, and 375 head. Costs for the commercially manufactured environment-controlled units were budgeted after reviewing (1) prices reported by producers interviewed; and (2) manufacturers price lists. It was assumed that the system would be erected by the manufacturer or contractor.

Costs of the environment-controlled units designed by the producer were budgeted from engineers' estimates of component part costs, and costs reported by the producers interviewed. A charge for labor used in construction is included. Total costs of these units might be high or low depending on how accurately producers estimated the amount of time required.

Construction costs of conventional units are also based on engineers' estimates of costs for component parts of the system. Here again, a charge for construction labor is included.

Budgeted costs for all sizes and systems are shown in Table 2. In each case, conventional units had the lowest cost and commercially fabricated and constructed units, the highest.

It is important to note the relative ease of acquiring commercially fabricated units. These can be ready for operation with little effort on the part of the buyer. Units designed and built by producers require more time for investigating ventilation and insulation requirements, shopping for materials, and supervision of construction. If the system does not function correctly, additional time may be necessary for correcting faults.

Some producers are constantly searching for new information on buildings and equipment as a part of their job in managing a swine enterprise. The time required for studying building specifications may not actually mean much additional time spent for these people.

Labor for construction of the standardized systems is budgeted at going wage rates, although the labor of a top producer-manager may be worth much more than the rate used. Insofar as the wage rate for the producer's time is understated, the commercially built units would have less of a disadvantage than is shown in Table 2.

Table 2. Estimated construction costs of standard swine finishing stystems.

Size and type of system	Building	Equipment	Lagoon	Total	Total per hog capacity
107 Head Capacity					
Environment-controlled					
Farm built	$3570	$ 1245	$165	$ 4980	$46.50
Commercially designed & built	5015	1726	165	6906	64.50
Conventional	1439	675	165	2279	21.25
226 Head Capacity					
Environment-controlled					
Farm built	5783	2027	299	8109	36.00
Commercially designed & built	9248	3182	299	12,729	56.50
Conventional	2923	1224	299	4446	19.75
375 Head Capacity					
Environment-controlled					
Farm built	8333	2917	420	11,670	31.00
Commercially designed & built	13,958	4792	420	19,170	51.00
Conventional	4730	1809	420	6959	18.50

On the other hand, if producers can construct the building at a time when there is no real alternative use for available labor, the costs of farm built units may be overstated in Table 2.

Thus, the decision as to which environment-controlled system a producer should buy can depend upon: (1) the producer's available time; (2) the producer's available capital; (3) the producer's abilities as a designer and builder; (4) the availability of proven building and equipment plans; and (5) cost of labor.

FEED HANDLING & PROCESSING

Automation of swine feeding chores can be accomplished economically. At the minimum, most producers employ self-feeders. In the survey, only one producer hand-fed his market hogs (Table 3).

Table 3. Type of feeding system in use on case farms.

Type of system	Automatic time interval	Self-feeder	Self-feeder auto-filled	Hand
Environment-controlled	10	2	2	1
Conventional	-	13	4	-

Six producers employed bulk bins and augers with automatic shut-offs to fill self-feeders. Fifteen other producers using self-feeders used various means of filling, including: (1) commercial grinder-mixer; (2) portable farm grinder-mixer; (3) auger wagon; (4) bulk feed delivery truck. None of the producers filled self-feeders with a shovel.

Ten of the producers with environment-controlled houses employed automatic-time-interval feeders which dropped feed on the floor. These systems included a bulk feed tank.

Management of the automatic-time-interval feeding systems varied between producers. Three producers limited feed to five pounds per day per hog. Another producer varied his feeding according to hog market expectations. He limited feed on an upward trend in the market, and full-fed on a downward trend. The rest of the producers with automatic-time-interval systems fed the hogs all that they would clean up.

Most producers farm-mixed their finishing ration with either their own or custom equipment.

MANURE HANDLING

Manure handling can be broken down into two functions: the cleaning of the facility, and the actual disposal of manure. Capital requirements for equipment which might be used to dispose of manure were not included in Table 2.

Conventional units can make use of liquid manure disposal systems; but without the slotted floors, daily cleaning is usually necessary. Consequently, more labor is required for cleaning than in an environment-controlled unit with slotted floors. The colder temperatures make it necessary to bed the sleeping area during the winter. Cleaning of the sleeping area was not needed often.

The selection of manure disposal methods generally reflect the views of producers concerning the value of manure. The spreading of solid manure on cropland rather than dumping it in a disposal area may be profitable since there is little difference between spreading and dumping costs.

Liquid manure, however, can be disposed of easily in a lagoon. Consequently, hauling and spreading liquid manure can be justified from a cost standpoint only if it results in increased crop production worth more than the cost of hauling and spreading.

Van Arsdall estimates that the investment in liquid manure hauling facilities would range from $2 per hog in a 2,500 head per year operation to $6 per hog in a 250 head per year operation.[3/] Annual hauling costs would range from $.62 per hog in a 2,500 head per year operation to $1.28 per hog in a 250 head per year operation.

The value of soil fertility elements initially present in liquid hog manure averaged $1.62 per hog in terms of 1960 prices for the same elements in straight commercial fertilizer materials. This value accumulated during a 170 pound weight gain (50 to 220 lbs.). The value of nutrients actually recovered by crops from the manure is an important factor in comparing the costs and returns from hauling liquid manure. Van Arsdall estimates that the average producer recovers less than 50% of the fertility value of the liquid manure spread on fields.

Personal or family considerations may also affect the selection of a manure disposal system. The odor of the lagoon was mentioned by most producers interviewed. None found the odor extremely objectionable, although disagreement was sometimes expressed by the women.

3/ R.N. Van Arsdall, The Economic Value of Manure from Confinement Finishing of Hogs, Bul. 687, Agr. Exp. Sta., University of Illinois, 1962.

HOG PRODUCTION COSTS COMPARED

Feed Costs

There is considerable doubt as to whether feed conversion is related to type of facility. Although there is some evidence that temperatures have a significant effect on feed conversion, work done at Wisconsin and Purdue Universities has not shown any significant relationship between feed conversion and the type of facility.

For purposes of comparing finishing systems in this study, two assumptions were made relative to feed conversion (amount of feed required per pound of gain): (1) equal feed conversion in all systems, and (2) a 5% difference in favor of the environment-controlled systems. The assumption with regard to feed conversion is stated where individual comparisons are made.

If the environment-controlled units actually do have a significant advantage, this has an important bearing on the relative costs of these systems as compared to the conventional systems. The first and third parts of Table 9 relate the costs and returns of producing a 210 pound market hog under each of the previously defined systems with equal rates of feed conversion. The second and fourth parts assume a 5% advantage in feed conversion in favor of the environment-controlled systems.

Rations used for the comparison of swine finishing facilities are those recommended by Nebraska animal nutritionists.[4] A 14% protein ration to 125 pounds, and a 12% ration from 125 to 210 pounds are assumed with an overall feed conversion rate of 3.25 pounds of feed per pound gain. Corn was priced at $1.12 per bushel and butcher hogs at $16.00 per hundredweight, thus giving a hog-corn ratio of 14.3. This is equal to the 1942-62 ratio.

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[4] L. E. Lucas, D. B. Hudman, and E. R. Peo, Jr., University of Nebraska Swine Ration Suggestions, Extension Circular 64-210, College of Agriculture and Home Economics, University of Nebraska, Lincoln, Nebraska, 1964.

Prices of the rations were $51.35 per ton for the 14% ration, and $49.30 per ton for the 12% ration. A charge of $3.50 per ton for processing and delivery to the bulk feed tanks was added.

Annual Building and Equipment Costs

Annual building and equipment costs were derived from investment costs by:

- Taxes -- 24%[5] x new price x 45 mills
- Interest -- 3% x new price (or 6% of average lifetime value)
- Insurance -- 0.005 x new price
- Repairs -- Buildings 1.5% x new price
  Equipment 3.0% x new price
- Depreciation -- Buildings, 10 and 15 year life compared
  Equipment, 10 year life, straight line method

Annual costs shown in Table 4 indicate a considerable difference between the commercially prefabricated and farm fabricated environment-controlled systems.

Engineers, and other persons in the field of farm building planning recommend the use of a 10 year life for environment-controlled system for two reasons: (1) uncertain obsolescence factor; and (2) uncertain life of specialized components.

The first reason is most important. A group of Illinois farmers who built hog facilities of the most recent design in the late 1950's are not satisfied with their units now. Since the facilities were built, slotted flooring has come into widespread use, insulation and ventilation requirements have been refined, and lagoon size requirements have

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[5] Average ratio of assessed value to actual value.

changed. The farmers in the Illinois study found it difficult and expensive to modernize their specialized facilities. Some have abandoned their units and constructed different finishing facilities.

Thus, the uncertain life of slotted floors and pen dividers is over-shadowed by the threat of rapid obsolescence of these specialized facilities.

A short depreciable life of a swine finishing system results in a relatively large annual building and equipment cost. Costs in Table 4 were computed with both a 10 and 15 year depreciable life. It may be appropriate to compare the costs of an environment-controlled system, using a 10 year life, with a conventional system, using a 15 year life.

Annual repair costs for environment-controlled systems are difficult to estimate. The units visited in this study had been in operation an average of 1.3 years. Generally, few repairs had been required. Several repair items reported were necessary because of improper operation or adjustment before the producer became familiar with new equipment in the system. Pulleys, V-belts, and trip cables were common examples of this type of repair.

Isolated examples of major repairs, or the need for some, were found. One producer was in the process of replacing the expanded metal portion of the floor in his building. Another producer was finding it necessary to do extensive patching on wooden pen dividers. Generally, wooden pen dividers had performed well if they were solid. Those requiring repair had been constructed with spaces between adjoining boards. One producer indicated that patching of his metal pen dividers would be necessary in the near future, as they were deteriorating badly near the floor.

Labor Requirements

Labor requirements are substantially affected by inclusion or exclusion of different jobs. For example, the time required for feed processing, manure handling, cleaning and disinfecting of buildings and equipment, maintenance of buildings and equipment, vaccination and medication, sorting and loading, or record keeping may not be included

Table 4. Annual building and equipment costs of selected swine finishing systems.

Annual costs	107 head capacity system			226 head capacity system			375 head capacity system		
	Environment-controlled		Conven-tional	Environment-controlled		Conven-tional	Environment-controlled		Conven-tional
	EC-1[b]	EC-2[c]		EC-1[b]	EC-2[c]		EC-1[b]	EC-2	
Depreciation									
Building and Lagoon (10 yr. life)	$373.50	$ 518.00	$160.00	$ 608.00	$ 933.00	$ 322.00	$ 875.30	$1437.80	$ 515.00
Building and Lagoon (15 yr. life)	249.12	345.50	107.00	404.00	637.00	215.00	583.82	959.01	344.00
Equipment (10 yr. life)	125.00	172.60	68.00	203.00	318.00	122.00	291.70	479.20	181.00
Taxes	53.78	74.58	24.61	87.58	137.48	48.01	126.04	207.03	75.16
Interest	149.40	207.18	68.37	243.27	381.87	133.38	350.10	575.10	208.77
Insurance	24.90	34.53	11.40	40.54	63.64	22.23	58.35	95.85	34.80
Repairs									
Building	56.02	77.70	24.06	91.23	143.20	48.33	131.30	215.67	77.25
Equipment	37.35	51.78	20.23	60.81	95.46	36.72	87.51	143.76	54.27
Total (10 year building life)	819.95	1136.37	376.69	1334.43	2094.65	732.67	1920.30	3154.41	1146.25
Total (15 year building life)	693.57	963.87	323.69	1130.43	1776.65	625.67	1628.82	2675.62	975.25
Total per hog marketed[a] (10 year building life)	2.55	3.54	1.17	1.97	3.08	1.08	1.71	2.80	1.02
Total per hog marketed[a] (15 year building life)	2.17	3.00	1.00	1.67	2.62	.92	1.45	2.38	.87

[a]Assuming a turnover of three groups per year

[b]Designed and built by farmers

[c]Designed and built by commercial firms

in the thinking of some people when they talk about the labor required to produce hogs.

Table 5. Average labor requirements, by jobs, for conventional and environment-controlled swine finishing systems on Nebraska farms visited.[a]

Job	Labor required per hog	
	Environment-Controlled System	Conventional System
	(Minutes)	(Minutes)
Observation and adjusting	9.6	4.0
Cleaning and bedding	2.7	22.9
Washing and disinfecting	1.4	2.5
Maintenance	1.2	0.8
Other[b]	2.5	3.5
Total	17.4	33.7

[a] Based on a field study of 25 finishing systems

[b] Time spent for medicating, marketing, and acquiring hogs, and record keeping. Time required for feeding, feed processing, and manure hauling are not included.

Table 5 shows that labor requirements for finishing hogs with the conventional, open front shed were nearly twice as high as those for the environment-controlled system. In either case, they are considerably less than those reported from a study of swine producing farms in Indiana in 1956-67 (Table 6).

More than half of the time spent by operators with the environment-controlled system was spent observing hogs and equipment and in making necessary adjustments in the equipment. Some operators made only one trip a day through the hoghouse while others made as many as three. For the most part, waterers were cleaned on either a daily or every-other-day basis. Automatic feeding equipment was adjusted according to the weight and appetite of the hogs at about 10 day or two week intervals.

Table 6. Relation of labor requirements to size of enterprise for growing-finishing hogs, on Indiana farms, 1956-57.[a]

Herd size	Labor required for hog
	(Minutes)
Under 150	59.6
150-300	46.0
301-450	39.4
451-600	39.4
601-750	36.2
751-900	34.8
Over 900	34.0

a/ R. H. Bauman, Ludwig M. Eisgruber, R. E. Partenheimer, and P. A. Powlen, Economics of Size and Economic Efficiency in the Hog Enterprise, Research Bulletin 699, Purdue University, 1961.

Pens were cleaned only when necessary while in use. Operators found it necessary to clean pens more often when pigs were small or before they adapted their habits to the slotted floor. Pens were usually given a thorough cleaning when emptied at marketing time.

Conventional houses were scraped out daily. Additional cleaning and bedding required extra labor from time to time. Producers with conventional facilities were able to observe their hogs while cleaning the shed but most of them did make at least one other visit to the hog facility sometime during the day for observation purposes.

Producers with conventional facilities spent more time cleaning their finishing facilities than those with environment-controlled facilities. Undoubtedly this was due partly to the absence of a slotted floor excreting area and to a greater area of floor space per animal.

More time was required for repair and maintenance in the environment-controlled systems because more use was made of mechanized feeding and watering equipment. (These systems had more waterers per 100 hogs than did the conventional systems). Most maintenance work in the conventional systems had to do with the repair of pen dividers and the shed itself.

Van Arsdall of Illinois (Economic Research Service) states that manure handling has been taking three-fourths of the total labor input used to grow and finish hogs. Elimination of jobs associated with the handling of manure can greatly reduce the labor requirement. Slotted floors virtually eliminate cleaning except for periodic scraping or washing. The liquid manure from these slotted floor systems can be disposed of in a lagoon, thus saving more time. The moderate temperature in the environment-controlled buildings makes bedding unnecessary, eliminating another chore.

There was a difference in labor requirements per hog related to the size of the operation (Table 7). Apparently an increase in size results in a much greater gain in labor efficiency for producers with conventional facilities than

Table 7. Average labor requirements for three size groups as observed in the field study of Nebraska farms, 1964.[a]

Size	Labor required per hog: Environment-controlled system	Labor required per hog: Conventional system
(200# Hog Capacity)	(Minutes)	(Minutes)
Group 1 (100 - 149)	21.0	46.5
Group 2 (150 - 249)	16.6	29.8
Group 3 (250 - 800)	16.3	26.0

[a] Includes labor for observation, cleaning and bedding, adjustment of automatic equipment, washing, spraying, disinfecting, maintenance, medication, and record keeping. Does not include time for feed processing, filling bulk feed tanks, or hauling manure.

for producers with environment-controlled systems. Producers with conventional systems and 250 to 800 hogs spent about 55% as much time per hog as those with 100 to 149 hogs. On the other hand, producers with environment-controlled systems and 250 to 800 head spent nearly 80 percent as much time per hog as those with 100 to 149 hogs.

Miscellaneous Costs

Bedding--The value of straw for bedding, as estimated by producers, was comparable to the 40¢ per hog bedding cost shown in the Purdue study.

Death Loss--Producers' estimates of death loss and injury averaged about 33¢ per hog, with no apparent difference due to facility type.

Veterinary and Medicine--Veterinary and medicine expenses of 14¢ per hog for the conventional system, and 18¢ per hog for the environment-controlled system as reported in the Purdue study were used for comparisons in this study.

Electricity--Producers' estimates of electricity costs were used. These amounted to 8¢ per hog for conventional systems and 40¢ per hog for the environment-controlled systems.

Marketing--An estimated marketing cost of 80¢ per hog was assumed.

Taxes (hogs)--Taxes were computed as follows:

130 pound pig x $18 per cwt. x 35% x 45 mills = 38 cents. Since only one group per year would be on hand on the tax assessment date, and a turnover of three groups per year is assumed, only one-third of the 38 cents was used as an average tax per hog produced during the year.

Interest (hogs and feed)--Interest on feed was estimated at 13¢ per hog (average feed investment x 6% simple interest). Interest for the investment in the hog was estimated at 28¢ per hog (average feeder pig investment x 6% simple interest).

Table 8. Estimated miscellaneous costs for two finishing systems.

Cost item	Environment-controlled	Conventional
	(per hog)	(per hog)
Death Loss	$ .33	$ .33
Veterinary and Medicine	.18	.14
Straw	-	.40
Electricity	.40	.08
Marketing	.80	.80
Interest (hogs and feed)	.41	.41
Taxes (hogs)	.13	.13
Total	$2.25	$2.29

Feeder Pig Price

Feeder pigs were priced at $13.60 on the basis of a 50 pound weight and market prices at the time the study was made.6/

Summary of Operating Costs

Table 9 summarizes the costs of finishing hogs under all three systems.7/ These figures are based on the medium size unit (226 hogs). Labor was valued at $2 an hour.

6/ L. E. Lucas, What To Pay For Feeder Pigs, Animal Science Department Mimeo., University of Nebraska, Lincoln, Nebraska, February, 1963.

7/ No allowance for general farm business overhead costs was included in Table 9. It is difficult to specifically allocate costs such as interest and taxes on the land in the farmstead, much of the farm share of auto, phone, and electricity, and other similar items. Yet, the productive enterprises must pay for such costs. No charge was made for the land actually used by the hogs either. Therefore, as one studies the costs shown, he should bear in mind that there are additional costs not shown.

Table 9. Relative costs of finishing a market hog as affected by depreciable life of building and rate of feed conversion.

	Environment Controlled		Con-
	Built by farmers	Commercially designed & built	ven- tional
10 yr. bldg. life-equal feed conversion			
Building and equipment	$ 1.97	$ 3.08	$ 1.08
Feed (160 pound gain)	14.04	14.04	14.04
Labor ($2.00 per hour)	.55	.55	.99
Bedding	-	-	.40
Veterinary and Medicine	.18	.18	.14
Death Loss	.33	.33	.33
Electricity	.40	.40	.08
Marketing	.80	.80	.80
Interest (hog and feed)	.41	.41	.41
Taxes (hog)	.13	.13	.13
TOTAL - Less Feeder Pig	18.81	19.92	18.40
Feeder Pig (50 pounds)	13.60	13.60	13.60
TOTAL COST - 210 pound hog	32.41	33.52	32.00
Returns (210 x $16 per cwt.)	33.60	33.60	33.60
Return over Costs	1.19	.08	1.60
10 yr. bldg. life-5% difference in feed conversion			
Feed (160 pound gain)	13.34	13.34	14.04
TOTAL COST-210 pound hog	31.71	32.82	32.00
Returns over Costs	1.89	.78	1.60
15 yr. bldg. life-equal feed conversion			
Building and equipment	1.67	2.62	.92
TOTAL COST-210 pound hog	32.11	33.06	31.84
Return over Costs	1.49	.54	1.76
15 yr. bldg. life-5% difference in feed conversion			
Building and equipment	1.67	2.62	.92
Feed (160 pound gain)	13.34	13.34	14.04
TOTAL COST-210 pound hog	31.41	32.36	31.84
Return over Costs	2.19	1.24	1.76

The first part of Table 9 shows costs based on equal feed conversion (conventional vs. environment-controlled) and a 10 year life for buildings and equipment. Under these conditions, cost of production would be slightly lower in a conventional unit than in either of the environment-controlled systems. Returns over all costs amounted to $1.60 per hog for the conventional system compared to $1.19 for the farmer erected environment-controlled system (EC-1) and $.08 for the commercially erected environment-controlled unit (EC-2).

In the second part of Table 9 it is assumed that the environment-controlled units require 5% less feed per pound of gain. If such an advantage actually exists, the environment-controlled units erected by farmers would be more profitable than the conventional units ($1.89 compared to $1.60).

Some researchers feel there is more than a 5% difference in feed conversion between the two types of systems. A 10% difference in feed conversion in favor of the environment-controlled systems would result in returns over costs of $2.63, $1.48, and $1.60, for EC-1, and EC-2, and the conventional systems, respectively.

Of course, there is also the possibility that an environment-controlled system may be designed and/or managed so that it produces a poorer rate of feed conversion than a conventional system would. This should be considered by the producer contemplating the purchase of an environment-controlled system and who is partially justifying the purchase by expectations of more efficient feed conversion.

The producer's own management ability may be more important in determining actual feed conversion than the system he uses.

The length of life used in budgeting building and equipment costs has an important effect on the relative costs and returns of one system compared to another. Therefore, it is important that the length of life and the rate of depreciation be as realistic as possible.

If a 15 year life is used on buildings and equipment as in the third and fourth parts of Table 9, costs for the environment-controlled systems become more competitive with those of the conventional system. Nevertheless, the conventional system still appears to be the most profitable if feed conversion rates are equal. Assuming that environment-controlled units reduce the feed requirement by 5%, the farmer erected environment-controlled units again are the most profitable, but the commercially erected units do not return as much as the conventional ones.

In comparing budgeted costs, some producers may prefer to use a 15 year life for the conventional system and a

10 year life for the environment-controlled system since obsolescence is less important with the conventional system.

Costs shown in Table 9 assume equally good performance from the farmer built and commercially built units. Some producers may not be able to build systems which would perform as well as the commercial ones.

Generally, budgets in Table 9 indicate that the conventional system is competitive with respect to costs and returns. The extra building and equipment cost associated with an environment-controlled unit is partially offset by reduced labor requirements. If the labor saved can be profitably employed elsewhere, the laborsaving feature becomes significant in terms of total farm earnings.

The controlled temperature conditions and limited feeding system may enable the producer to market hogs which grade higher than they would if finished in a conventional system. This point has yet to be conclusively proven, however.

With the assumptions of this study, it is not possible to justify the purchase of an environment-controlled finishing system on a cost-of-production basis. However, certain non-monetary, physical considerations may be important.

For example, the dislike which some producers may have for choring in adverse weather may influence their decisions. An environment-controlled unit permits a producer to perform daily or periodic duties on schedule through all types of weather. A desire to experiment with something new and unknown may also be a factor.

IMPORTANCE OF MAKING FULL USE OF BUILDINGS AND EQUIPMENT

Annual costs are higher for the environment-controlled systems (Table 10). Most of these costs (depreciation, interest, taxes, insurance) are fairly constant regardless of the level of use of the system and have an important effect on the costs of production per hog.

Table 10. Annual building and equipment costs for three swine finishing systems.[a]

Farm built environment-controlled	$1334
Commercially designed and built environment-controlled	2095
Conventional	733

[a]Assumes 226 head capacity unit and 10 year building life

Figure 1 shows building and equipment costs per hog, assuming different levels of facility use. There is a spread of $1.08 between the costs at 100% and 50% of capacity with the conventional systems. The comparable spread for the commercially built environment-controlled system is $3.08. Thus, building and equipment costs per hog mount rapidly when the high investment buildings are not used to full capacity.

When selecting a system, the producer should carefully consider comparisons similar to those in Figure 1. His farrowing schedules may not enable him to keep the building operating at 100% capacity. Disease outbreaks or reproductive difficulties in a breeding herd may make it necessary to operate a system at 50% or 25% of capacity for a period of time; this would have a marked effect on income.

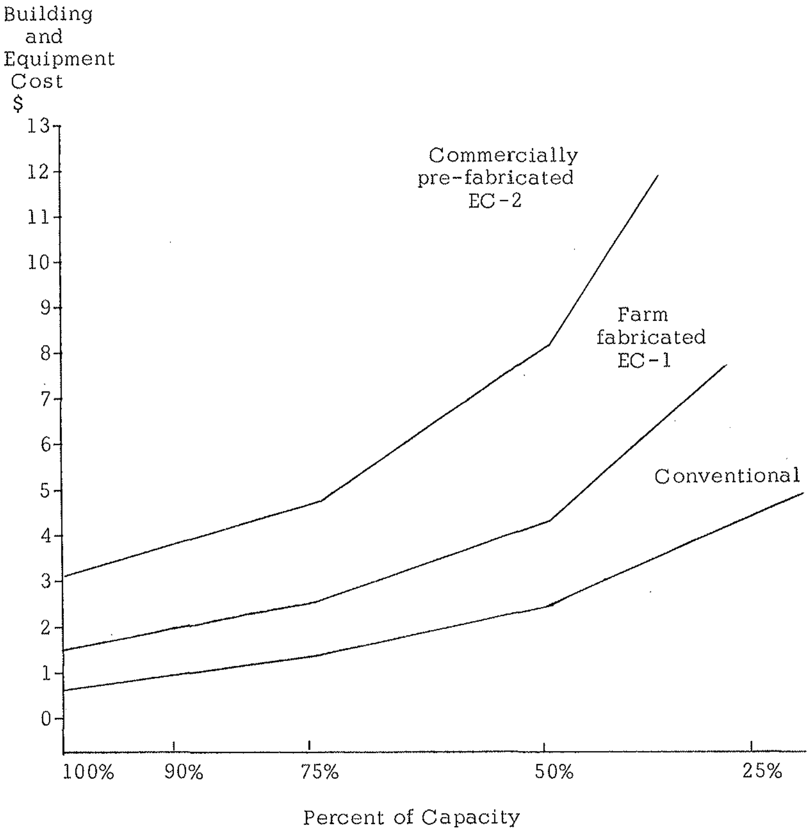
During the field study, nearly every environment-controlled system visited was operating at less than 100% capacity. One producer visited was operating his facility at less than 50% capacity, due to difficulties in his breeding herd.

Most producers were having trouble timing their farrowings so that their environment-controlled units could operate continuously at 100% capacity. Those who did have their systems operating at 100% capacity usually had older, conventional finishing facilities on the farm where they could finish the overflow from the environment-controlled system,

FIGURE 1

BUILDING AND EQUIPMENT COSTS PER HOG

AS AFFECTED BY INTENSITY OF FACILITY USE[a]



[a]Ten year building and equipment life, 226 head capacity systems.

or start pigs on feed while waiting for those in the environment-controlled system to reach market weight. The additional cost of the "overflow" facilities should not be overlooked, however.

Temperature in the environment-controlled system is another important consideration when operating at less than full capacity. When pigs are small, or when the system is operating at less than full capacity, supplemental heat is often needed to maintain a desired temperature in the building.[8]

In the units visited, thermostats were usually set to maintain a 55 degree temperature. A temperature of 50-55 degrees facilitates the proper operation of the ventilation system and its removal of moisture. Aside from maintaining a desired temperature for the hogs, a temperature of at least 32 degrees is needed to keep the plumbing from freezing.

The various problems associated with incomplete use can be solved with experience but until they are solved, the producer must be financially and physically prepared for them.

Size of Operation

Building and equipment costs per hog decline as the size of a system increases. This is a direct function of the reduced investment per hog capacity.

The conventional system becomes relatively more competitive from the standpoint of labor cost as size increases, but the environment-controlled systems become relatively more competitive from the standpoint of building and equipment costs. The latter overshadows the first, and in total, the environment-controlled systems become more competitive with increasing size of system, within the limits of this study.

MANAGEMENT CONSIDERATIONS AND COST COMPARISONS FOR SYSTEMS ALREADY IN OPERATION

So far, comparisons have assumed that the producer is contemplating the purchase of a finishing system. But what are the important cost considerations for comparative purposes after the systems are installed or erected?

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[8] Approximately one-third of the farms visited had provisions for supplemental heat.

When contemplating the purchase, all building and equipment costs may be considered as variable costs. Once the purchase had been made, however, most building and equipment costs must be considered as fixed costs. These are the costs which occur from year to year regardless of the level of use. They include depreciation, interest on the investment, insurance, and taxes. Fixed costs on the three systems discussed are shown in Table 11.

Table 11. Annual fixed building and equipment costs.

	Environment-controlled		Conventional
	Built by farmers	Commercially designed & built	
Total annual building cost	$1334	$2095	$733
Less repair expense of	152	239	85
Total annual fixed cost	1182	1856	648

Now and then hog producers run into low prices or other difficulties which threaten to reduce income. Returns from an enterprise might drop to a point where they would be just equal to total costs, and profit would disappear. The immediate conclusion might be that a person might as well stop producing; but closer study soon reveals that this is not necessarily true. At this point, the farmer must begin to think in terms of how losses can be held to a minimum.

Hog buildings and equipment are highly specialized and probably have little alternative use. Fixed costs such as those shown in Table 11 will be incurred even though the buildings and equipment stand idle. Moreover, the hogs have been providing employment for 186 hours of labor a year at $2.00 an hour, and it may be difficult to find other uses for this labor. If other uses for the buildings, equipment, and labor cannot be found, there are $1554 in costs (fixed costs on buildings and value of labor) which cannot be saved or avoided by going out of the hog business.

If a producer with EC-1 facilities large enough to produce 678 hogs a year stays out of the hog business for a full year, his hog facilities or enterprise would net him a loss of $1554 for that year.

Suppose he decides to keep on producing even though he feels reasonably sure that gross income per hog is likely to be as low as $31- how would he fare then? According to the figures in Table 9, he would be losing $1.41 per hog or a total of $956 a year. But this is less than the cost of the buildings and equipment without any offsetting income ($1182) and much less than the total of fixed costs plus labor ($1554). Continued production under circumstances such as this permit him to employ his labor at $2 an hour and realize $226 ($1182 minus $956) to apply toward the fixed costs of buildings and equipment.

It's true, of course, that a farmer never knows exactly what he can expect in the way of either income or expense, but he can and does make assumptions on the basis of the best information he can get.

A partial budget is a good management tool to use in analyzing the possible or probable effects of any change in operation. Table 12 illustrates how cost figures such as those shown in Table 9 can be used together with income assumptions to arrive at an estimate of the probable effect of going out of the hog business for a year. The net effect of -$601 says that a producer would experience more of a drop in income than he could save in costs. This indicates that the farmer would be better off to continue to produce, even though he is producing at less than cost.

The -$601 is the same as the value of the labor normally used on the hog enterprise (186 hrs. x $2 per hr.) plus the $226 realized toward the fixed costs of buildings and equipment except for rounding of figures in the partial budget.

With the commercially constructed environment-controlled unit, annual return over costs becomes zero when the return over costs per hog drops $.75. But, the return over costs per hog must drop nearly $3.70 before the producer's losses are equal to what they would be if the system were idle.

The return over costs per hog can drop nearly $2.00 with EC-1 system before total returns become zero. A decline of nearly $3.75 must be realized before total losses exceed the costs associated with the idle system.

Table 12. Partial budget showing effect of staying out of hog business vs. continued production.

Increased income			
None			$ ---
Reduced costs			
Pigs (13.60 x 678)	$9221		
Repairs on buildings	152		
Feed ($14.04 x 678)	9519		
Vet. & medicine (.18 x 678)	122		
Death loss (.33 x 678)	224		
Electricity (.40 x 678)	271		
Marketing (.80 x 678)	542		
Interest & taxes (.54 x 678)	366		
Total		$20417	
Gross benefits		$20417	
Reduced income			
Sale of 678 hogs @ $31			$21018
Increased expenses			
None			---
Gross costs			$21018
Net effect			
Gross benefits $20417 less gross costs $21018 = -$601 (loss)			

The return over costs per hog can drop about $1.50 below that of the present situation before they become zero for the conventional system. They become equal to the loss associated with an idle system when returns over costs drop $2.70 per hog.

Thus, producers may continue feeding out pigs in an "unprofitable" situation to minimize losses. Others may continue production during unprofitable seasons in order to maintain continuity in their total hog operation.

SUMMARY

Construction costs were budgeted for three kinds of confined finishing units: environment-controlled units constructed by a commercial concern, environment-controlled units constructed by a farmer, and conventional open shed units with adjacent cement feeding floors.

1. Costs were greatest for the commercially built environment-controlled units and lowest for the conventional units. Investments in manure disposal equipment and facilities were not included in construction cost budgets.

2. A majority of producers with environment-controlled units employed some kind of automatic-time-interval feeding system; most of those with conventional systems used self-feeders.

3. Cleaning pens was a daily chore with conventional units. Slotted floors used with the environment-controlled units virtually eliminated the cleaning chore once the pigs became accustomed to the system. This accounts for an important part of the difference in total labor requirements.

4. Hauling and spreading of liquid manure may not be justified from a cost standpoint except in large operations if one assumes that 50% or less of the fertility elements is actually recovered. Other considerations, particularly objectionable odors and the possibility of water pollution, may be of primary importance.

5. A comparatively rapid rate of depreciation probably should be used for highly specialized facilities such as environment-controlled finishing systems and their equipment because of obsolescence. The rate of depreciation is more important as the amount of capital investment increases. The rate of depreciation has an important bearing on comparisons.

6. Labor requirements per hog were essentially twice as high on farms with conventional units as on farms with environment-controlled units. Cleaning and bedding pens accounted for about 2/3 of the total time requirement with conventional units while observation and adjustment of

equipment accounted for a little more than half of the time requirement with environment-controlled units.

7. Labor requirements per hog are related to the size of the operation.

8. Costs of producing hogs are lowest with conventional finishing units if feed conversion rates are equal. If environment-controlled units actually have better rates of feed conversion, as some data indicate, their competitive position is strengthened. Research reports are not conclusive on the relative rates of feed conversion but little difference is indicated by most studies.

The reduced labor requirement of environment-controlled systems permits handling more hogs with any given amount of labor. This may more than offset the higher cost of production on farms where labor is scarce.

9. Full use of facilities is important, particularly with the high investment units.

10. Environment-controlled units are more competitive when hog operations are large and available labor is severely limited.

11. Once facilities are installed, it is economically sound to continue production as long as returns are greater than variable costs.

12. Net returns above costs as shown in Table 9 must cover the use of land and a share of general overhead costs in the farm business as well as management.