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Pork Production Systems with Business Analyses The High-Investment, High-Intensity Confinement System (Continuous Farrowing with 21 Groups of Sows, Farrow-to-Finish)

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Continuous Farrowing System

This farrow-to-finish production system is the most intensive system presently used in the pork industry in terms of frequency of use of buildings. The illustration used in this fact sheet is 21 groups of 24 sows per group (504 sows). It is a highly specialized production program in which all functions of pork production and marketing take place each week. It is characterized as a highly capitalized, low labor, intense management unit with specialized buildings using sophisticated equipment and automation. It is used where the business of producing pork is the primary, and most frequently, the only objective. Obviously, this is a long-term commitment to produce pork. The manager is frequently hired or may be an owner or stockholder. Usually the employees have specialized assignments - i.e., farrowing-nursery, breeding-feed processing, or growing-finish-marketing. A unit of this size (504 sows) will require four or five employees, one of whom is a working manager.

Advantages

1. Low labor requirements per pig produced, allows high productivity per employee.
2. Allows maximum use of capital investment.
3. Hogs are marketed one or more times each week, spreads out income.
4. Per pig boar costs are lower due to heavy use of boars.
5. Allows labor to be specialized in production function.
6. Easier to reward labor for specific job based on incentive.

7. Sows and gilts are easily added into a production schedule since essentially continuous breeding permits females to be bred anytime they cycle.
8. Confinement systems allow for a more constant environment, regardless of weather, and should result in more efficient production.

Disadvantages

1. Requires a large capital outlay that few individuals have the assets to support.
2. Results in a large negative cash flow during construction and start-up phase.
3. Requires skilled labor which is often difficult to obtain and more difficult to keep.
4. Total confinement systems have little economic flexibility to change the size of the production unit with changes in cost of inputs and outputs.
5. System is highly dependent on mechanical devices for maintaining the necessary environment, skill in maintenance must be available.
6. This system has a high energy requirement and energy saving devices or alternate energy sources should be considered in design and construction.
7. Possibility for non-productive animals to become concentrated in the replacement pool.
8. Sufficient land must be available to dispose of the large amount of waste. Actual land requirements will vary with type of waste management system used.
9. Labor management skills are very important and may be more important than production skills.
10. Disease potential is often increased by the large concentration of animals in confinement.

Designing the Continuous Farrowing System

Physical Facilities

Because of the intensity with which all facilities are used, careful attention should be directed to building design and layout to facilitate efficient flow of feed, hogs and waste and to minimize physical and environmental stress on the animals. Each structure or compartment within a given structure should be designed to do a specific job effectively (i.e., farrowing, weaning, etc.). As with other intensive systems, these units should be constructed so that "all-in, all-out" management practices can be used in the farrowing and nursery-weaning areas.

Breeding and Production Schedule

Since farrowing will occur each week, breeding must take place each week also. This greatly simplifies the problems associated with less intensive systems where sows are kept in groups with periods when breeding is not permitted. However, one specific management hazard with all intensive systems is the opportunity for gilts and sows to get into the replacement "pool" and get lost. This has resulted in rather extended intervals between litters for some sows. Another hazard of this "pool" principle is the danger of carry-over sows and non-breeders concentrating into a group of "hard-breeders." A group of this nature will often have a conception rate of less than 50%. Sows or gilts that fail to conceive after two matings to fertile boars should be culled. One way to avoid the carry-over problem in the pool would be to have one or more pens of replacement females from which matings can occur for 30 days. Any unbred females left in these pens after 30 days would be sent to slaughter. Additional replacements selected during this 30-day period would be held in another set of pens from which matings would be made during the next 30 days. All mated females not returning to heat should be pregnancy-checked at approximately 35 days after mating.

Developing a breeding-farrowing schedule for a continuous farrowing program is relatively simple since all phases of production and marketing take place each week. However, it is one of the more difficult systems to manage since the flow of animals from one point to another at the proper time is critical. There is little time flexibility built into the schedule.

Continuous farrowing can be assigned for an approximate weaning age of 3, 4, or 5 weeks. For the 4 week weaning, 21 sow groups are required with 5 farrowing rooms. For the 3 week weaning, 20 sow groups are needed but only 4 farrowing rooms. However, it demands exceptional management ability to wean successively at 3 weeks.

A 4 week weaning schedule allows sows to be in the farrowing house 4 days before farrowing starts, plus 29 days for the oldest pigs and 1 or 2 days of clean-up time. There would be no additional down time. Some producers use a continuous farrowing program with 6 farrowing areas in order to wean at 4 weeks and allow for a week of down time. This does not make maximum use of the farrowing house, although it does provide some management flexibility as far as the time available for emptying each farrowing room and cleaning and disinfecting before refilling with the next group of sows.

If pigs are to be weaned at 5 weeks of age, 6 farrowing areas will be needed. However, it is generally accepted that in a system as intensive as continuous

farrowing, leaving the pigs with the sows for 5 weeks is not practical.

Production Schedule and Facility Requirements

Table 1 illustrates a production schedule for continuous farrowing. Five farrowing rooms, eight nursery rooms, and growing-finishing facilities for the production of fourteen farrowing groups are required. Some variation in these basic requirements is possible, as noted in the table footnotes.

The facilities shown in Table 2 correspond to this production schedule and are specifically designed to handle 504 sows and 20 boars on a weekly farrowing schedule. Twenty-one groups of 24 sows are maintained with 24 bred each week to fill one to five 20-stall farrowing houses. If more than 20 sows conceive, piglets from the smaller litters can be combined to provide space for the additional sows.

Cost of facilities may vary considerably in various parts of the country. Some producers might be able to cut the initial cost by performing some or all of the supervision and labor.

Daily labor demands throughout the week are distributed as shown in Table 3. This table illustrates one of the advantages of continuous breeding and farrowing; namely, uniform distribution of labor demands over time. Because continuous farrowing units tend to be "large" scale operations with several full-time employees, it permits specialization among the work force. One individual can be responsible for farrowing, another responsible for managing the breeding, etc.

Estimating Budget

The estimated budget (Table 4) for 1040 litters from 504 sows involves 21 groups of 24 sows with an 83% conception rate. The overall feed conversion is 4.0 pounds of feed per pound of hog sold. A high level of management should result in a feed conversion at least as favorable as this. Care should be taken to maintain a healthy herd, prevent feed waste at the feeders and select top quality breeding stock.

Income

The income used in the estimated budget (Table 4) is based on selling 220 lb. market hogs for an average of \$48 per cwt. Assuming 1040 litters with 8 pigs sold per litter gives 8320 market hogs. Of these, 281 were kept as replacements. Seventy of the 281 gilts failed to settle and were sold at 300 pounds for \$45 per cwt. Ten sows were assumed to have died requiring a total of 211 replacement gilts for the 201 cull sows sold.

Boars are kept an average of two years with one death loss per year and 9 boars to be sold each year.

Direct Costs

Almost 90% of total, direct costs is for feed. Corn is valued at \$3.00 per bu. and soybean meal is valued at \$250 per ton. Creep feed is valued at \$12 per cwt.

Overhead Expenses

The cost of labor, repairs, interest on investment and depreciation on capital items including breeding stock make up the overhead expenses in the budget. Labor is valued at \$5.00 per hour. Facility overhead cost is 16.5% on items depreciated over 15 years, and 22.5% for items with an 8 year depreciation. Overhead on breeding stock is based on \$78,000 invested in sows and boars at 14%. Interest on market hog inventory is 14% of \$80,392, which is the average amount of operat-

Table 1. Continuous farrowing production schedule (expressed as day-of-year).

Sow group	Begin breeding	Into far. house	Far. room	Wean, move to nursery	Nur.* room	Move to grower-finisher**	Sell by***
1	0	110	A	143	A	198	296
2	7	117	B	150	B	205	303
3	14	124	C	157	C	212	310
4	21	131	D	164	D	219	317
5	28	138	E	171	E	226	324
6	35	145	A	178	F	233	331
7	42	152	B	185	G	240	338
8	49	159	C	192	H	247	345
9	56	166	D	199	A	254	352
10	63	173	E	206	B	261	357
11	70	180	A	213	C	268	364
12	77	187	B	220	D	275	371
13	84	194	C	227	E	282	378
14	91	201	D	234	F	289	385
15	98	208	E	241	G	296	392
16	105	215	A	248	H	303	399
17	112	222	B	255	A	310	406
18	119	229	C	262	B	317	413
19	126	236	D	269	C	324	420
20	133	243	E	276	D	331	427
21	140	250	A	283	E	338	434
1****	147	257	B	290	F	345	441

*With eight nursery rooms oldest pigs are 84 days old when transferred to grower-finisher. If younger pigs are desired for this move, additional grower-finisher capacity must be constructed and this additional capacity subtracted from the nursery requirements.

**Single or multiple growth stage facilities. However arranged, total capacity must hold fourteen weeks of production.

***Oldest pigs in each group are approximately 182 days of age (296 minus 114) when marketed.

****Repeat sequence starting over with sow group 1.

Table 2. Facilities investment for continuous farrowing 504 sows.

Facility	Years of life	Size & Description	Cost	Your figures
5 Farrowing houses	15	20 stalls - total slats	\$100,170	_____
5 Farrowing houses equipment	8	farrowing crates, ventilation, heating and creep feeders	42,930	_____
Nursery - 8 rooms	15	20 pens - over flush gutter	34,440	_____
Nursery - 8 rooms equipment	8	decks, feeders & waterers	49,560	_____
Sow confinement & breeding	15	408 sows plus 50 replacement gilts - free stall & flush gutter	124,280	_____
Mill building	15	400 sq. ft.	4,000	_____
Feed mill	8	mill & augers	18,000	_____
Grain storage and elevator legs	15	70,000 bu. capacity (2/3 of needs)	70,000	_____
Feed bins	15	15 bins	10,650	_____
Feeding floor	15	2240 head capacity	133,660	_____
Feeding floor equipment	8	feeders, waterers, feed distribution & ventilation	57,285	_____
Truck	8	2 1/2 tons	16,000	_____
Waste system	15	lagoons	20,000	_____
Pick up truck	8	3/4 ton	8,000	_____
Waste handling	8	irrigation or tank	20,000	_____
Incinerator	8		1,000	_____
Generator	8		15,000	_____
Breeding stock				
Gilts		600 head @ \$130	78,000	_____
Boars		20 head @ \$450	9,000	_____
Total Investment			811,295	_____

Table 3. Work-load distribution, continuous farrowing.

Activity	Days required						
	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.
Wean, move sows & pigs				X			
Breed	X	X	X	X	X		
Clean farrowing house				X	X		
Load farrowing house					X	or X	
Farrow			X	X	X	X	X
Move sows from breeding to gestation			X				
Empty and clean nursery		X	X				
Sell hogs	X	X					

Table 4. Estimated budget for 1040 litter (504 sow operation).

Item	Amt.	Units	504 Sows	Your figures
A. Income				
1. Market hogs (220 lbs. @ \$48/cwt.)	8039	hd.	\$848,918	_____
2. Cull sows (425 lbs. @ \$38/cwt.)	201	hd.	32,461	_____
3. Cull gilts (300 lbs. @ \$45/cwt.)	70	hd.	9,450	_____
4. Cull boars (425 lbs. @ \$30/cwt.)	9	hd.	1,147	_____
5. Gross income			\$891,976	_____
B. Direct costs				
1. Feed				
a. Corn (\$3.00/bu.)	107,016	bu.	\$321,048	_____
b. Soybean meal (\$12.50/cwt.)	11,650	cwt.	145,000	_____
c. Premix (\$17.50/cwt.)	1,931	cwt.	33,792	_____
d. Creep feed (\$12.00/cwt.)	1,645	cwt.	19,740	_____
e. Total feed			\$519,580	_____
2. Vet. & medication (\$1/hd. sold)			8,319	_____
3. Boar purchase	10	hd.	4,000	_____
4. Power & Fuel			19,100	_____
5. Marketing (\$1/hd.)			8,319	_____
6. Interest on corn stored (4.67 mos. @ \$26,754/mo.)	14	%	17,492	_____
7. Miscellaneous			2,250	_____
8. Total direct costs			\$579,060	_____
C. Overhead expenses				
1. Investment overhead				
a. 15 yr. depreciable facilities (16.5%)	497,200		\$ 82,038	_____
b. 8 yr. depreciable facilities (22.5%)	227,775		51,249	_____
c. Breeding stock (14%)	78,000		10,920	_____
d. Interest on market hog cost inventory (14%)	80,392		11,255	_____
e. Total investment overhead			\$155,462	_____
2. Labor (\$5/hr.)	10,000	hrs.	50,000	_____
3. Total overhead expenses			\$205,462	_____
D. Summary				
1. Net return to land and management			\$107,454	_____
2. Per hr. return to labor, land & mgt.			\$15.74	_____
3. Return on investment excluding land		%	19.3	_____

ing costs tied up in market hog production for more than 30 days during the year.

Summary Calculations

Net return to management and land is the amount of income left after all direct cost and all overhead expenses including labor have been paid.

Per-hour returns to labor, land and management were computed by adding the cost of labor (\$50,000) to the return to land and management (\$107,454) and dividing by 10,000 hours.

In computing returns on investment, \$26,000 were charged for management and land. Ten percent of the facility and breeding stock costs was charged as depreciation. All direct costs as well as labor were included as shown in the budget. The computation was as follows:

\$107,454	returns to land and management
- 26,000	for land and management
\$ 81,454	net returns
+155,462	investment overhead
- 81,197	(10% depreciation on \$811,975)
	livestock and facility investment
\$155,719	returns on investment

Dividing \$811,975 into \$155,719 gives 19.2% returns on investment. This is after repairs and depreciation have been paid.

In computing the return to any single input, all costs except the cost for that input must be subtracted from the gross income.

Estimating Monthly Cash Flow

The estimated monthly cash flow (Table 5) is for a beginning operation purchasing the first group of gilts the first of October. The first group is bred the end of October. Feed is assumed purchased as it is fed during the first year. This gives an accurate account of feed consumed, but it may not coincide with what actually happens. With grain storage facilities and a feed mill, a producer would probably purchase most of the grain needed for the first year in September and October.

Gilt and boar purchases were not included in the cash flow because they are considered a part of the

capital investment items. No interest appears in the first year's cash flow because it is assumed that no cash interest will be paid until there is a positive cash flow from which to pay the interest. The same holds true for payments to be made on principal owed.

The cash flow shows the greatest deficit (\$140,202) during the eleventh month when the first market hogs are sold. The sale of market hogs begins the middle of August. Therefore, only half as many are sold as are sold each month thereafter. Under this multiple farrowing system, top hogs are sold each week.

A cash flow for an ongoing operation would be of value primarily to indicate the cash expenses and receipts since no deficit should occur. The sale of market hogs each month should always be more than that month's cash expenses as long as any returns above operating costs are being realized.

During the second year of this 504 sow operation, income should exceed cash expenses by \$26,076 each month. By the end of the second year, the positive cash flow should be approximately \$199,397. This is \$26,076 times 12 minus the \$113,515 deficit at the end of the first year.

Performance

Reducing the overall feed conversion from 4 lb. of feed per pound of hog sold to 3.7 lb. is a 7.5% decrease in feed used. This decreases the feed bill by \$38,968 and increases the returns to land and management from \$107,454 to \$146,422. Obviously, feed conversion is very important.

Market Price

Each \$1.00 per cwt. change in the average price received for hog changes the expected net income by \$18,788. Based on these figures, with corn at \$3.00 per bu. and soybean meal at \$12.50 per cwt., a market hog price of \$43.60 per cwt. is needed to pay all expenses including land rent and management. This is with an overall feed conversion of 4 lb. of feed per pound of pork sold and with all other costs as shown in the preceding budget (Table 4).

Table 5. Cash flow for 1040 litter (504 sow) first year's operation* (buying first gilts October 1).

Item	Total	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Estimated cash receipts													
990 market hogs (220 lbs. @ \$48/cwt.)	104,544											34,848	69,696
76 cull gilts (300 lbs. @ \$45/cwt.)	10,260					6,480	540	540	540	540	540	540	540
60 cull sows (425 lbs. @ \$38/cwt.)	9,690							1,615	1,615	1,615	1,615	1,615	1,615
Total estimated cash receipts	124,494												
Estimated cash expenses													
Sow & boar feed	58,699	1,496	2,218	3,242	4,172	5,221	6,050	6,050	6,050	6,050	6,050	6,050	6,050
Pig feed creep	10,861						835	1,671	1,671	1,671	1,671	1,671	1,671
Pig feed 18% starter	17,439						758	1,516	3,033	3,033	3,033	3,033	3,033
Pig feed 16% grower	27,500							2,500	5,000	5,000	5,000	5,000	5,000
Hog feed 14%	28,445								3,161	6,321	6,321	6,321	6,321
Hog feed 13%	54,177									7,248	13,380	15,610	17,939
Miscellaneous	1,407	20	40	60	80	100	120	140	150	160	170	180	187
Electricity & Fuel	13,500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500	1,500	1,500
Vet. & medication	4,031	100	100	100	150	200	283	283	383	483	583	683	683
Repairs	13,200	200	400	600	800	1,050	1,150	1,250	1,350	1,450	1,550	1,650	1,750
Truck expenses	2,550	60	60	60	80	380	140	140	140	150	180	480	680
Insurance & taxes	6,200	350	350	350	350	350	350	350	350	350	350	2,350***	350
Total estimated cash expenses	238,009	2,826	3,868	5,212	6,532	8,301	10,786	15,100	22,588	33,316	39,788	44,528	45,164
Net monthly cash flow**		(2,826)	(3,868)	(5,212)	(6,532)	(1,821)	(10,246)	(12,945)	(20,433)	(31,161)	(37,633)	(7,525)	26,687
Cumulative cash flow		(2,826)	(6,694)	(11,906)	(18,438)	(20,259)	(30,505)	(43,450)	(63,883)	(95,044)	(132,677)	(140,202)	(113,515)

*Includes only operating expenses. Does not include gilt or boar purchases.

**Parentheses () indicate negative values.

***Assumes \$2000 taxes paid in August.