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Pork Production Systems with Business Analyses The High-Investment, High-Intensity Confinement System – Pork Industry Handbook

Michigan State University Extension Service

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pork industry handbook

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Pork Production Systems with Business Analyses The High-Investment, High-Intensity Confinement System (5-Groups of Sows Farrow-to-Finish)

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High-Investment, High-Intensity Confinement... What It Is and Where It Fits

This production system requires a long-term commitment to the business of producing pork. It is characterized by specialized facilities with sophisticated equipment and a highly organized and recognizable "system" or "schedule." Therefore, this system is used most frequently where the business of producing pork is the primary objective, or at least, has priority on management and labor necessary to normal production. It is a low labor system, and normally, all animals are totally confined. The production schedule is designed for breeding and farrowing each month, or 12 farrowings per year. Following are the basics for this schedule:

1. The sow herd is divided into 5 distinct groups.
2. One group is bred each month.
3. Breeding is restricted to 7 days.
4. Pigs are weaned at 5 weeks of age.
5. Sows are rebred on first cycle after weaning.

It is obvious that this system requires good management and dedication. Since it is impossible for one person to be available continuously, more than one person should be involved to assure continuous operation and time off for weekends or vacations.

Advantages

- Low-labor requirement. System is designed so that the per man productivity is quite high.
- Confinement system provides a more constant environment for improved hog and labor productivity.
- Labor can be specialized; for instance, personnel might specialize in farrowing-nursery, breeding-finishing, marketing-feed processing.

- Labor needs are fairly constant from month-to-month since all phases of production take place each month.
- Hogs are marketed one or more times each month. Therefore, income will be spread through the year, minimizing the cash-flow problem.
- Boar cost per pig will be lower since each boar will sire more pigs.
- Per sow investment is lower because of more intensive use of buildings.
- Facilities can be designed for specialized functions, i.e., deck nursery, breeding.
- Controlled breeding schedule allows breeding herd to be managed more efficiently since the sows can be observed more readily. Hand-mating allows for more control of the mating process and ensures complete services.

Disadvantages

- High investment in management.
- Replacement gilts are difficult to work into the breeding schedule.
- Sows that do not conceive on schedule are difficult to manage in this system.
- Mechanical equipment must be serviced or replaced.
- Keeping skilled labor available and happy can be a problem in large units.
- Requires a controlled breeding program; works best with hand-mating.

The Five-Group Production System

Once the decision has been made to use a 5-group system for producing pork, buildings necessary for doing this job with maximum efficiency must be chosen. The layout should be designed for efficient flow of animals, feed, waste and people. These structures will be designed spe-

cifically for a given production function, i.e., farrowing, nursery. Basic to successful use of this system is the necessity of the "all-in, all-out" principle in the farrowing and nursery areas. The principle will require a restricted breeding period of not more than 7 days. Exposure of 15-20% more females than space available in the farrowing house is necessary to compensate for conception failures. The percentage or number of "extras" exposed will depend on the conception rate expected. The restricted breeding period will mean that all pigs farrowed by a group of sows will have an age difference of no more than 7 days. Since the sows are bred on the first cycle following weaning, synchronization of the heat cycle is not a problem under normal conditions of 5-week weaning. Extra replacement gilts must be available so that some may be cycling with each sow group to be bred.

In large production units, the farrowing house should be sub-divided into small rooms or compartments. Compartmentalization allows sows and pigs in that room to be managed similarly. The nursery should be designed in a similar manner. The nursery should be designed so that one room or compartment will handle the production of one room or compartment from the farrowing house. This will ensure that the "all-in, all-out" principle is followed, which allows cleanup opportunity to get ready for the next group.

These rooms or compartments in the farrowing house and nursery should be designed so that each room is a self-contained unit with its own heating, ventilating and waste system. This design allows for a total sanitation program (even fumigation) to be used between groups. Special attention must be given to disease control when buildings are used intensively. This design helps make management easier in preventing diseases.

Schedule of Building Use in a Five-Group System Farrowing House

This system should be designed using one farrowing area and a sow and litter nursery. The required farrowing stalls can be in one large room or in smaller rooms. It is suggested that not more than 20 farrowing stalls be in one room. If more stalls are needed, then sub-dividing into rooms will simplify management. Also it is easier to control air flow and heat. It also facilitates the grouping of sows so that pigs nearer the same age are in each room.

In a once-a-month farrowing schedule with a maximum of 7 days breeding exposure and 5-week weaning, a nursery to which the sow and litter are moved is necessary. Using 2 farrowing areas and a dry (pigs only) nursery is very inefficient use of the most expensive structure in a hog operation—the farrowing house.

The schedule for the farrowing house is as follows:

1. Sows are moved into the farrowing house 4 days before farrowing.
2. Sows and pigs are moved to the nursery when oldest pigs are about 23 days old—youngest pigs will be 16 days old.
3. This schedule allows 3 days for clean-up time in farrowing house before bringing in the next group of sows.

Nursery

Sufficient space will be required to accommodate 2 production groups in the nursery. One group will be sows and pigs, and the other group will be weaned pigs. The house design for sow and litter takes various forms. Some nurseries are designed so that each sow and her litter are housed together in individual pens until weaning. In others, pens may have 2-3 sows and litters housed together. The 2

groups may be in adjoining rooms with solid wall separation, yet the same heating system may serve both age groups by letting the duct system run the full length of both rooms. Supplemental heat is supplied for the younger pigs as needed. After weaning, the sows go to the breeding barn and two to three litters of pigs are penned together to constitute one feeding group in the nursery and in the growing-finishing facility.

The schedule for the nursery is as follows:

1. Sows and litters are moved to nursery when oldest pigs are about 23 days old; youngest could be about 16 days old.
2. Pigs are weaned and sows are moved to breeding barn when oldest pigs are 35 days old; youngest could be 28 days old. Pigs stay in litter pens for additional 2 wks.
3. Pigs are grouped into larger pens (2-3 litters per pen) at about 7 wks. of age. This allows about 4 days clean-up time before the next group from the farrowing house is scheduled for the individual litter pens.
4. Grouped pigs are moved to the finishing area at about 11 wks. of age.

Finishing

The finishing facility should have the capacity to hold the production of 4 groups of sows at one time. This design allows enough space so that hogs can be carried to heavier weights when prices so dictate. Normally, 11-week-old pigs can be expected to stay in the finishing house about 100-120 days. This would make the youngest pigs about 177 days old and the oldest pigs 197 days old when sold. The capacity for 4 groups will allow extra time for different levels of performance during different seasons of the year, heavy hogs on a rising market or space for developing replacement gilts. Since housing costs are quite high, space requirements are normally conservatively estimated and all available space in confinement units is fully used.

Breeding-Gestation

Production units may be designed with breeding and gestation facilities together or as separate structures. Either system can work and does not change the total space required. In a breeding schedule that is restricted to not more than 7 days, boar power becomes critical. Because of the cycling pattern that exists in sows weaned as a group following 5 weeks of lactation, a large number of services will be required in a short period of time. It is suggested that one healthy, active, breeding-age boar be available for each 3 sows to be bred in a given breeding period. Extra boar power is good insurance with this schedule to be sure that all sows that cycle in a given period are adequately serviced. It is very expensive to have sows in heat and only crippled or sick boars that cannot work.

It is desirable to have sufficient holding pens in the breeding area to house a full group of sows until the next group forces them out to the gestating area. On a 5-group system, this will allow 30 days in the breeding area so that sows that recycle can be detected and rebred with a minimum of trouble.

As was previously indicated, one of the disadvantages of the once-a-month schedule is recycling sows. If a sow cycles late in the breeding period in a given month and fails to conceive and recycles 20-22 days later, she could fit with the next breeding group but would be 2-3 days ahead of the regular group. So a management decision must be made as to what to do with recycling sows. Should they be bred or sold? If not bred on first recycle, then they do not fit with the next group on the next cycle either. So the opportunity is present for sows to be carried over an extensive

period of time in the sow pool and not fit into the schedule. Realistically, most producers will get the sow bred and find a place for her to farrow if they are short on inventory. If the herd inventory is adequate, then the recycling sow will be sold. The capital gains advantage of selling breeding stock is added incentive to sell off non-reproducers.

The gestating area can be designed many different ways, but basically if individual stalls are not used, the number of sows or gilts penned together should be kept down to workable numbers. This means that females are put together based on size, age, disposition and health. For most producers, 6-8 sows or gilts penned together is a desirable number.

The gestation area should be sufficient to house 3 groups of sows plus replacement gilts, in addition to the space available in the breeding area. If the breeding area is not separate from the gestating area, then space should be available for 4 groups of sows plus space for the number of boars needed and space for replacement gilts. Replacement gilts should be housed so that exposure to boar's odor, sight and sound will stimulate normal development. If breeding takes place in a separate facility, space should be available near the boar area so that gilts can be housed there to stimulate sexual maturity and estrus.

Labor Needed

Labor requirements vary greatly from farm to farm. If it is assumed that the man hours will be directed to the production of pork and not to growing feed, etc., then it is expected that about 21 hrs. of labor is required per sow unit in a production system as described. This is about 1.4 hrs. per pig farrowed and fed to market weight.

Management

Effective use of facilities and labor requires the development of a production schedule which, in turn, puts all major activities on a calendar basis. For example, sows are weaned on a given date with breeding to be accomplished at first cycle, which fixes the schedule for farrowing, etc. By replacing the sow herd at the rate of 40% per year and assuming a 75% conception for gilts and 90% conception for sows, a pool of females of 15-20% more than planned to farrow will be required. A typical schedule is shown in Table 1.

Scheduled activities that fall on a weekend can be shifted 1 day in either direction to allow only routine chores for weekend work. Also, many producers will vary the schedule to wean on Thursdays so as to start breeding on Mondays, again avoiding weekends.

For specific suggestions on management practices for normal production, see other PIH fact sheets in this "PRODUCTION" series.

Table 2 shows acceptable performance standards for a 95 sow, high-intensity confinement unit with estimates of feed use and labor requirements. A sow herd of 95 sows is not a full-time operation and as previously indicated, extra help is required with an intensive production system to allow for time away from the job. Even though these thoughts seem to be in conflict, the 95 sow unit does illustrate the point that an intensive production system can be used in a size unit adaptable to a total farming operation as well as to a much larger unit that concentrates on pork production only. In a total farming operation, there is usually some hired help available as needed in the swine unit. If the system is designed as the only source of income, then obviously, the unit would be much larger than 95 sows and would require additional labor.

Table 3 shows an estimate of feed tonnage needed annually for a 95 sow unit.

Table 1. Breeding and production schedule.

Group	Breeding period 7 days	Farrowing begins	Move to nursery	Wean
A	Jan. 4	Apr. 28	May 21	June 2
B	Feb. 4	May 29	June 21	July 3
C	Mar. 6	June 28	July 21	Aug. 2
D	Apr. 6	July 29	Aug. 21	Sept. 2
E	May 6	Aug. 28	Sept. 20	Oct. 2
A	June 7	Sept. 28	Oct. 21	Nov. 2
B	July 7	Oct. 29	Nov. 21	Dec. 3
C	Aug. 6	Nov. 28	Dec. 21	Jan. 2
D	Sept. 6	Dec. 29	Jan. 21	Feb. 2
E	Oct. 6	Jan. 28	Feb. 23	Mar. 4
A	Nov. 6	Feb. 28	Mar. 23	Apr. 4
B	Dec. 7	Mar. 31	Apr. 23	May 5
C	Jan. 6	Apr. 30	May 23	June 4
D	Feb. 6	May 31	June 23	July 5
E	Mar. 8	June 30	July 23	Aug. 4
A	Apr. 8	July 31	Aug. 23	Sept. 4
B	May 9	Aug. 31	Sept. 23	Oct. 5
C	June 9	Sept. 30	Oct. 23	Nov. 4
D	July 9	Oct. 31	Nov. 23	Dec. 5
E	Aug. 8	Nov. 30	Dec. 23	Jan. 4
A	Sept. 8	Dec. 31	Jan. 23	Feb. 4
B	Oct. 9	Jan. 31	Feb. 23	Mar. 7
C	Nov. 8	Mar. 2	Mar. 25	Apr. 6
D	Dec. 9	Apr. 2	Apr. 25	May 7
E	Jan. 8	May 2	May 25	June 7

Table 2. Performance standards for farrow-to-finish production using 95 sows to farrow 16 litters per month for a total of 162 litters per year.

Item	Standard	Annual results
Conception rate	85%	192 litters
Litters/sow/year	2.02	192 litters
Live pigs/sow/litter	10.0	1920 pigs
Pigs weaned/litter	8.0	1536 pigs
Mortality—weaning		
to market	1.5%	23 pigs
Replacement gilts	40%	36 gilts
Hogs marketed		1477 hogs
Age at market weight		185 days
Rate of gain		1.2 lb./day
Feed utilization	3.75 lb. feed/lb. pork	609 tons
Labor	1.4 hr./pig	2080 hr./yr. (40 hr./wk.)
Building use—farrowing	once/mo.	12 per yr.
Live pigs/crate	10/mo.	120/yr.
Nursery-sow and litter group pens	once/mo.	12/yr.

Table 3. Annual feed requirements for a 95 sow herd farrow-to-finish.

Type of feed	Amount
Grain	980,357 lb. (17,506 bu. corn)
Supplement—breeding herd	65,832 lb. 33 tons
—market hogs	153,608 lb. 77 tons
Creep feed	25,920 lb. 13 tons

Facilities

Facilities shown in Table 4 are designed to accommodate 95 sows and 6 boars on a 31-day schedule. One group of 19 sows is bred every 31 days; subsequently 16 sows will farrow on the same schedule.

The initial investment for facilities may vary from the estimate in Table 4 depending on the individual farmer's situation. In cases where the farmer will do some of the work involved in constructing the facilities, the initial investment may be less than the amount shown.

Estimating Budget

The estimated budget for 192 litters from 95 sows involves 5 groups of 19 sows with an 85% conception rate. An overall feed conversion of 3.75 was used in determining the feed requirements for the operation. To maintain a feed conversion that is this favorable, the manager must do a good job of selecting and feeding breeding stock, preventing feed waste at the feeders, keeping the herd healthy and free of parasites.

Income

The income used in the estimated budget in Table 5 is based on selling 220 lb. market hogs for an average of \$40 per cwt., assuming 192 litters with 8 pigs produced per litter gives 1513 market hogs. Fifty gilts are kept for replacement. Fourteen of the 50 gilts failed to settle and were sold at 300 lbs. for \$38 per cwt. Boars are kept an average of 2 yrs., leaving 3 of the 6 boars maintained to be sold each year. A total of 36 sows are sold each year at 425 lbs. for \$35 cwt.

Direct Costs

More than 87% of total direct costs is for feed. Corn is valued at \$2.40 per bu. and 40% protein supplement is valued at \$12.00 cwt. The 18% baby pig feed is valued at \$10.00 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 \$4.00 per hour. Facility overhead cost is 15.5% on items depreciated over 15 yrs., and 21.5% for items with an 8 yr. depreciation. Overhead for breeding stock is based on \$14,345 or \$151 per sow at 10.4%. No cost is shown for operating inventory. Expenses for an on-going operation that is farrowing on the indicated schedule will be paid as they occur.

Summary Calculations

Net return to management and land is the amount of income left after all direct costs 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 (\$8320) to the return to management and land (\$17,709) and dividing by 2080 hours of labor.

In computing returns on investment, \$7000 were charged for management and land. Ten percent of the facility and breeding stock costs was charged as depreciation, insurance and taxes. All direct costs as well as labor were included as shown in the budget. The computation was as follows: \$17,709 returns to land and management minus \$7,000 for land and management = \$10,709 net returns: \$10,709 + \$28,688 (investment overhead) - \$16,576 (10% depreciation, insurance and taxes on \$165,760 livestock and facility investment) = \$22,821 return on investment. Dividing \$165,760 into \$22,821 gives 13.8% returns on investment. This is after repairs, depreciation, insurance and taxes have been paid.

Estimating Monthly Cash Flow

The estimated monthly cash flow, Table 6, is for a beginning operation with the first group of gilts purchased in

Table 4. Facilities investment for a 5-group system using 95 sows (192 litters farrowed).

Facility	Years of life	Size and description	Cost	Your figures
Farrowing house, flush	15	16 stalls—total slats	\$ 12,500	
Farrowing house equipment	8	Farrowing crates, ventilation, heating, and creep feeders	8,500	
Nursery, flush	15	256 hd.—total slats	15,525	
Nursery equipment	8	Ventilation, heating, feeders, waterers, and feed distribution	9,920	
Sow confinement, curtain sides, flush	15	Partial slats—72 hd.	11,760	
Sow confinement equipment	8	Waterers, plumbing and ventilation	3,360	
Breeding barn, flush	15	26 hd.—partial slats	10,400	
Breeding barn equipment	8	Ventilation, heating and cooling	8,500	
Feeding floor, flush	15	Total slats 512 hd.	28,510	
Feeding floor equipment	8	Feeders, waterers, feed distribution and ventilation	20,640	
Mill building	15	400 sq. ft.	2,000	
Waste holding system	15	Lagoons	4,600	
Well	15	Cost may vary considerably	1,600	
Feed mill	8	Mill and augers	8,000	
Feed bin	15	16 ton capacity feed storage	2,400	
Generator	8	25 kilowatt	2,200	
Incinerator	8		1,000	
Total facilities investment			\$151,415	
Investment per sow			1,594	
Investment per hog produced yearly			103	

Table 5. Estimated budget for a 192 litter (95 sow) operation.

Item	One sow	95 sows	Your figures
A. Income			
1. Market hogs (220 lbs. @ \$40/cwt.)	\$1355.20	1463 hd.* =	\$128,744.
2. Sows (425 lbs. @ \$35/cwt.)	56.37	36 hd. =	5,355.
3. Non-breeders (300 lb. @ \$38/cwt.)	16.80	14 hd.* =	1,596.
4. Boars (425 lb. @ \$28/cwt.)	3.76	3 hd. =	357.
5. Gross income	\$1432.13		\$136,052.00
B. Direct Costs			
1. Feed			
a. Corn (\$2.40/bu.)	\$ 442.25	17,506 bu. =	\$ 42,014.
b. Protein supplement 40% @ 12¢/lb.	277.14	2,194 cwt. =	26,328.
c. Creep feed (\$10/cwt.)	27.37	260 cwt. =	2,600.
d. Total feed	\$ 746.76		\$ 70,942.00
2. Veterinarian and medicine	23.11	\$1.50/hd. =	2,195.
3. Boar purchase (3 @ \$400)	12.63		1,200.
4. Power and fuel	40.21		3,820.
5. Marketing	28.72		2,728.
6. Miscellaneous	4.74		450.
7. Total direct costs	\$ 856.16		\$ 81,335.00
C. Overhead expenses			
1. Investment overhead			
a. 15 yr. depreciable facilities (15.5%)	\$ 145.68	\$ 89,295	\$ 13,840.
b. 8 yr. depreciable facilities (21.5%)	140.59	62,120	13,356.
c. Breeding stock (10.4%)	15.71	14,345	1,492.
d. Total investment overhead	\$ 301.98	\$165,760	\$ 28,688.00
2. Labor (\$4/hr.)	87.58	2,080 hrs.	8,320.
3. Total overhead expenses	\$ 389.56		\$ 37,008.00
D. Summary			
1. Net return to land and management	\$ 186.41		\$ 17,709.00
2. Per hr. return to labor, land and management			12.51
3. Return on investment excluding land			\$22,821 ÷ \$165,760 = 13.8%

* 1463 market hogs and 14 nonbreeders = market hogs sold shown in Table 2.

Table 6. Estimated cash flow for a 192 litter, 95-sow first year's operation.* (Dollars) (Buying first gilts Oct. 1).

Item	Total	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.
Estimated cash receipts													
244 market hogs (220 lb. @ \$40 cwt.)	\$21,473											\$10728	\$10728
46 cull gilts (300 lb. @ \$38 cwt.)	5,244						2280	684	684	456	456	456	456
Total estimated cash receipts	26,717						2280	684	684	456	11184	11184	
Estimated cash expenses													
Sow and boar feed	6,798	352	572	530	665	737	704	523	540	559	534	558	524
Sow lactation feed	2,722					66	373	373	384	361	406	384	375
Pig feed (18%)	839						23	122	138	137	138	150	133
Pig feed (16%)	4,836						449	847	898	872	872	898	
Hog feed (14%)	4,844							551	1025	1103	1103	1062	
Hog feed (13%)	7,752								780	2243	2243	2486	
Miscellaneous	167	10	10	10	10	15	16	16	16	16	16	16	16
Electricity	752	20	25	25	25	30	50	70	80	90	100	110	127
Fuel	145					25	25	25	20	10			40
Vet and medication	893						18	55	91	128	165	201	235
Repairs	680					50	60	70	80	90	100	110	120
Truck expenses	150	5	5	5	5	5	5	10	10	10	10	40	40
Insurance and taxes	600	50	50	50	50	50	50	50	50	50	50	50	50
Total estimated cash expenses	\$31,178	437	662	620	755	978	1324	1763	2807	4154	5737	5837	6106
Net monthly cash flow**		(437)	(662)	(620)	(755)	(978)	(1324)	517	(2123)	(3470)	(5281)	5347	5078
Cumulative cash flow**		(437)	(1099)	(1719)	(2474)	(3452)	(4776)	(4259)	(6382)	(9852)	(15133)	(9786)	(4708)

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

** Parentheses () indicate negative values.

October. Only cash expenses are included in the cash flow with no expense shown for purchasing breeding stock, interest or loan repayment. For the first year, feed is assumed to be purchased as it is fed. This gives an accurate account of feed consumed, but it may not coincide with what actually occurs. With grain storage facilities and a feed mill, a producer would probably purchase most of the grain needed for the first year in September or October.

The cash flow shows the greatest deficit during the tenth month, just before the first group of market hogs is sold.

A cash flow for an on-going operation would be of value primarily to indicate the total 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. Income would exceed cash expenses by approximately \$5078 each month during the second year of operation. The cumulative cash flow would be +370 for the

13th month and would increase \$5078 each month during the remainder of the second and subsequent years.

Performance

Changing the feed conversion from 3.75 to 4.0 reflects a 6.6% change. Based on the price of feed used in this publication, each 6.6% change in feed conversion will change the expected net income by \$4682.

Market Price

Each \$1.00 cwt. change in the average price received for all hogs will change the expected net income by \$3426. A \$6.00 reduction in price would reduce the net by \$20,556, which would leave a minus \$2852 return to land and management in the preceding budget. With \$2.40 corn and \$12.00 cwt. supplement, \$34.54 cwt. hogs would be about a break even price.

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