

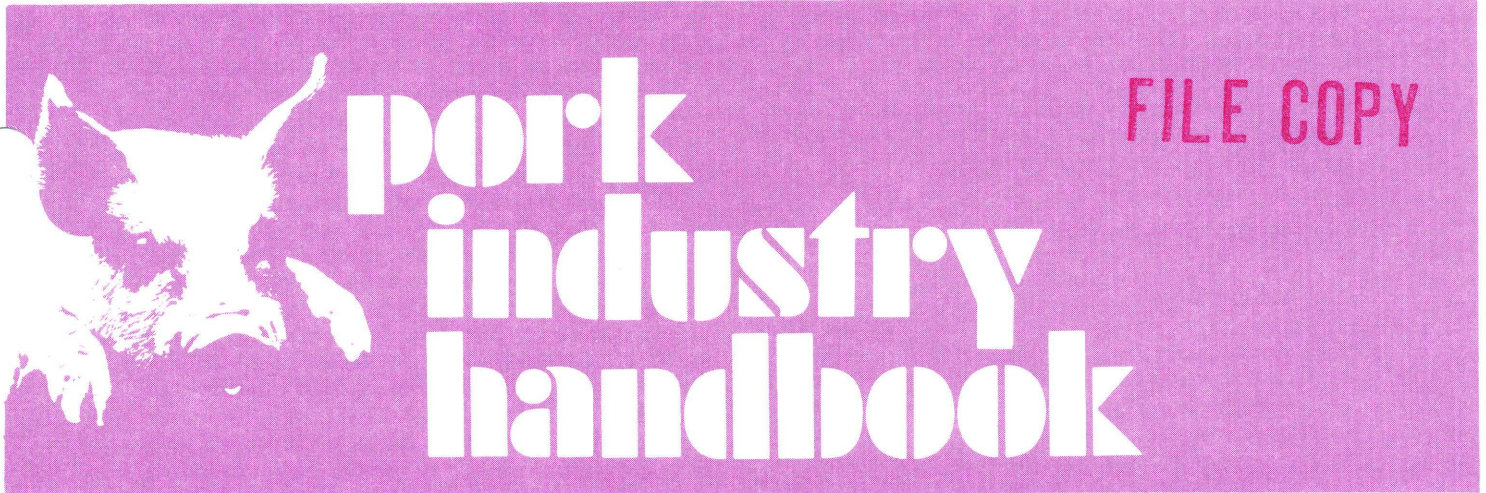
## **MSU Extension Publication Archive**

Archive copy of publication, do not use for current recommendations. Up-to-date information about many topics can be obtained from your local Extension office.

Pork Production Systems with Business Analyses The High-Investment, High-Intensity Confinement System : Pork Industry Handbook  
Michigan State University Extension Service  
Charles M. Stanislaw, Kelly D. Zering, Jack W. Parker, North Carolina State University  
Revised June 1991  
6 pages

The PDF file was provided courtesy of the Michigan State University Library

**Scroll down to view the publication.**



COOPERATIVE EXTENSION SERVICE • MICHIGAN STATE UNIVERSITY

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

### Authors

Charles M. Stanislaw, North Carolina State University  
Kelly D. Zering, North Carolina State University  
Jack W. Parker, North Carolina State University

### Reviewers

Michael Brumm, University of Nebraska  
Richard P. Kesler, University of Illinois  
Allan Lines, The Ohio State University

### Continuous Group Farrowing System

This farrow-to-finish production system is a very intensive system 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, intensively managed 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-finishing-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 intensive use of capital investment.
3. Hogs are marketed more frequently which spreads out income and reduces market risk.
4. Improved marketing opportunities because of constant flow of consistent quality hogs.

5. Per pig boar costs are lower due to heavy use of boars.
6. Allows labor to be specialized in production function.
7. Easier to reward labor for specific job based on incentive.
8. Sows and gilts are easily added into a production schedule since essentially continuous breeding permits females to be bred any time they cycle.
9. This system allows for a more constant environment, regardless of weather, and should result in more efficient production.

#### Disadvantages

1. Requires a large capital outlay.
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. High-investment 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. 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.

## Design for Continuous Group Farrowing

### 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 throughout the system.

### 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.

As with any intensive system, sufficient replacement gilts must be available to replace all the sows that are culled so that a full farrowing group is assured each time. These gilts need to be well developed, sound, and from a productive maternal line. They can be produced by a specialized within-herd crossing program or they can be purchased from others who specialize in gilt production.

Developing a breeding-farrowing schedule for a continuous group 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 group farrowing can be planned for an approximate weaning age of 3 or 4 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, an ideal nursery environment is necessary to wean successfully 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. If producers use

a continuous group farrowing program with 6 farrowing areas in order to wean at 4 weeks, this will allow for an additional 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.

Obviously, to maximize production efficiency in an intensive system such as this, a complete record system will be mandatory. Because of the volume of data that will be generated, a computerized system would be especially helpful. Whatever record system is used, however, it must be able to track individual breeding animals and provide regular updated summaries for each sow, each boar, each farrowing group, and for the total herd. Farrowing rates, litter sizes, survival rates, growth rates, feed efficiencies, market weights, etc. must be available and studied regularly. Performance charts can be very helpful in making production analyses. While the use of records will not guarantee success, the absence of records will essentially guarantee failure.

### Production Schedule and Facility Requirements

Table 1 illustrates a production schedule for continuous farrowing. Five farrowing rooms, five nursery rooms, and growing-finishing facilities for the production of seventeen 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 25 boars on a weekly farrowing schedule. Twenty-one groups of 24 sows are maintained with 24 bred each week to fill one of the 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 cash expense by performing some or all of the construction, 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 an Annual Budget

Income and costs will vary across locations and over time. Prospective investors should prepare budgets using the prices that apply to their specific situation. The estimated annual budget (Table 4) for 1040 litters from 504 sows involves 21 groups of 24 sows with an 83% farrowing rate. The overall feed conversion is 3.5 pounds of feed per pound of hog produced. 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 230 lb. market hogs for an average of \$47 per cwt. Assuming 1040 litters with 8.73 pigs finished per litter yields 9081 market hogs per year. Of these, 235 were kept as replacements. Twenty-four gilts failed to set-

**Table 1. Continuous group 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	177	296
2	7	117	B	150	B	184	303
3	14	124	C	157	C	191	310
4	21	131	D	164	D	198	317
5	28	138	E	171	E	205	324
6	35	145	A	178	A	212	331
7	42	152	B	185	B	219	338
8	49	159	C	192	C	226	345
9	56	166	D	199	D	233	352
10	63	173	E	206	E	240	359
11	70	180	A	213	A	247	366
12	77	187	B	220	B	254	373
13	84	194	C	227	C	261	380
14	91	201	D	234	D	268	387
15	98	208	E	241	E	275	394
16	105	215	A	248	A	282	401
17	112	222	B	255	B	289	408
18	119	229	C	262	C	296	415
19	126	236	D	269	D	303	422
20	133	243	E	276	E	310	429
21	140	250	A	283	A	317	436
1****	147	257	B	290	B	324	443

\*With 5 nursery rooms oldest pigs are 63 days old when transferred to grower-finisher. If older or younger pigs are desired for this move, appropriate changes must be made in the capacity of the nursery and the capacity of the grower-finisher.

\*\*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 group farrowing 504 sows.**

Facility	Years of life	Size and Description	Cost	Your figures
5 Farrowing rooms	15	20 stalls each, controlled environment	\$120,995	_____
5 Farrowing rooms equipment	8	Farrowing crates, ventilation, heating, creep feeders, etc.	51,855	_____
5 Nursery rooms	15	20 pens, controlled environment	58,189	_____
5 Nursery rooms equipment	8	Pens, feeders, & waterers	83,735	_____
Sow confinement & breeding	15	354 sows, 50 replacement gilts, & 25 boars - free stall & flush gutter	153,291	_____
Feeding floor	15	2975 head capacity	214,712	_____
Feeding floor equipment	8	Feeders, waterers, feed distribution and ventilation	92,023	_____
Feed bins	15	13 bins	12,780	_____
Waste system	15	Lagoons	22,918	_____
Waste handling	8	Irrigation or tank	24,000	_____
Truck	8	2 1/2 tons	22,000	_____
Pickup truck	8	3/4 ton	11,000	_____
Incinerator	8		1,201	_____
Generator	8		11,960	_____
<b>Basic facilities subtotal</b>			<b>\$880,659</b>	_____
Mill building	15	400 square feet	4,189	_____
Feed mill	8	Mill & augers	21,600	_____
Grain storage and Elevator legs	15	70,000 bu. capacity (2/3 of annual needs)	84,000	_____
<b>Feed mill subtotal</b>			<b>\$109,789</b>	_____
Breeding stock sows and gilts		504 head @ \$150	75,600	_____
boars		25 head @ \$575	14,375	_____
Subtotal 8 yr. property			\$319,374	_____
Subtotal 15 yr. property			671,074	_____
Subtotal breeding stock			89,975	_____
<b>TOTAL INVESTMENT</b>			<b>\$1,080,423</b>	_____

tle and were sold at 300 pounds for \$42 per cwt. The remaining 211 gilts replaced 201 cull sows that were sold and 10 sows that died.

Boars are kept an average of about 2 years with one death loss and 11 cull boars sold each year.

### Direct Operating Costs

About 80% of direct operating cost is for feed. Corn is valued at \$2.65 per bu. and soybean meal is valued at \$225 per ton. Creep feed is valued at \$15 per cwt. and vitamin-mineral premix is valued at \$17 per cwt. Annual repair costs are included in the miscellaneous category.

**Table 3. Workload distribution, continuous group farrowing.**

Activity	Days required					
	Mon.	Tues.	Wed.	Thurs.	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	X	X	X	

\*This workload distribution can be altered significantly by the use of induced farrowing.

**Table 4. Estimated annual budget for 1040 litter (504 Sow) operation.**

Item	Price	Units	Amount	Value 504 sows	Your figures
<b>A. Income</b>					
1. Market hogs @ 230 lbs.	\$47.00	cwt.	20,346	\$956,260	_____
2. Cull sows @ 425 lbs.	38.00	cwt.	854	32,462	_____
3. Cull gilts @ 300 lbs.	42.00	cwt.	72	3,024	_____
4. Cull boars @ 500 lbs.	30.00	cwt.	55	1,650	_____
5. Gross income	\$46.58	cwt.	21,327	\$993,396	_____
<b>B. Direct costs</b>					
1. Feed					
a. Corn	\$ 2.65	bu.	103,446	\$274,133	_____
b. Soybean meal	11.25	cwt.	11,948	134,419	_____
c. Premix	17.00	cwt.	2,855	48,534	_____
d. Creep feed	15.00	cwt.	1,680	25,197	_____
e. Feed additives	125.00	cwt.	131	16,375	_____
f. Total feed	\$ 6.694	cwt.	74,544	\$498,658	_____
2. Vet. & medication	1.50	hd.	9,081	13,661	_____
3. Electricity & fuel	28.53	litter	1,040	29,670	_____
4. Marketing & truck expense	2.46	hd.	9,081	22,337	_____
5. Miscellaneous	63.70	sow	504	32,102	_____
6. Boar purchase	575.00	hd.	12	6,900	_____
7. Total direct costs	\$ 28.29	cwt.	21,327	\$603,328	_____
<b>C. Overhead expenses</b>					
1. Investment overhead					
a. Facilities (15 Year Life)	16.18%		\$671,074	\$108,580	_____
b. Facilities (8 Year Life)	21.63%		319,374	69,081	_____
c. Breeding stock	12.00%		89,975	10,797	_____
d. Interest on stored corn (40% of annual use)	12.00%		109,653	13,158	_____
e. Interest on market hog inventory	12.00%		404,832	48,580	_____
f. Total investment overhead	15.69%		\$1,594,908	\$250,196	_____
2. Labor	\$6.00	hrs.	10,000	60,000	_____
3. Total overhead expenses	\$14.54	cwt.	21,327	\$310,196	_____
<b>D. Summary</b>					
1. Net return to land & management	\$3.759	cwt.	21,327	\$79,873	_____
2. Return on investment excluding land and management	12.49%				_____

### Overhead Expenses

The cost of property taxes, property insurance, interest on investment including swine inventory, stored corn, depreciation of capital items and labor make up the overhead costs in the budget. Labor is valued at \$6.00 per hour. Facility overhead costs include 1.5% property insurance and taxes, and annual interest and depreciation (amortization) factors of 14.68% on property with 15 years of expected life and 20.13% on property with 8 years of expected life. Annual interest cost on swine inventory is calculated as 12% of \$89,975 invested in breeding stock plus 12% of \$404,832 invested in market hog inventory (calculated as the average amount of costs tied up in growing pig inventory on any day of the year).

Annual interest on the stored corn is calculated as 12% of the value of \$109,653 (the value of 40% of annual corn purchases).

### Summary Calculations

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

In calculating "return on investment excluding land", \$31,302 was charged for management (3% of gross income) and land (\$1500 annual rent). Depreciation was calculated as 1/15 times the amount invested in 15 year property plus 1/8 of investment in 8 year property. Property tax and insurance were calculated as 1.5% of invest-

ment in 15 and 8 year property. All direct costs plus labor were included as shown in the budget. The calculation was as follows:

\$ 79,873 returns to land and management  
- 31,302 land and management allowance

\$ 48,571 net profit  
+ 250,196 investment overhead  
- 84,660 depreciation  
- 14,857 property tax and insurance

\$ 199,250 returns on total investment

Dividing \$199,250 by \$1,594,908 equals 12.498% return on total investment. This is after repairs, depreciation, property tax and insurance have been paid.

### Estimating Monthly Cash Flow

The estimated monthly cash flow (Table 5) is for a beginning operation purchasing the first group of gilts (approximately 5.5 months of age) on the first of August. The first group is bred at the end of September. 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 the timing of actual feed purchases. 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 and labor are included in the cash flow to provide a better estimate of when cash will be required. Interest and principal payments on itemized long-term debt are included in the first year's cash flow. Since there is no positive cash flow from which to make those payments, operating loans are used to finance the deficit.

The cumulative cash flow shows the greatest deficit (\$474,072 plus \$20,735 in accrued interest) during the twelfth month when the first mortgage payment is made. This cash deficit is approximately offset by the investment in swine inventory which reaches full capacity in the eleventh month. The sale of market hogs begins in the middle of June. Therefore, only half as many are sold in June as are sold in each month thereafter. Under this multiple farrowing system, about 170 market hogs are sold each week.

A cash flow for an ongoing operation would be of value primarily to indicate monthly cash receipts and

expenses since no operating deficit should occur. A cash flow for an ongoing operation is useful in scheduling debt payments and capital expenses that may otherwise result in overall cash deficits in particular months.

During the second and later years of this 504 sow operation, regular cash receipts should exceed cash expenses including labor, property tax and insurance, and boar replacement by \$315,211 (based on Table 4). This is equivalent to a monthly net cash flow of \$26,268. Cumulative net cash flow (assuming a \$162,804 annual mortgage payment and excluding income tax) is expected to reach \$0 and turn positive 35 months after the end of the first year or 47 months after the first gilts were purchased. An additional operating loan is required to make the mortgage payment in the 48th month. Mortgage payments in the fifth and subsequent years can be made from internal cash flow.

### Effects of Production Performance

Reducing the overall feed conversion from 3.5 to 3.4 lb. of feed per lb. of swine sold reduces the feed bill by \$13,787. Thus, each decrease of 0.1 lb. feed per lb. sold increases net return to management and land by \$13,787. Each additional market hog sold increases gross income by \$103.50 and increases net returns to land and management by \$53.34. A decrease of 1 market hog sold per litter decreases net returns to management and land by \$55,470 (1040 x \$53.34). Increasing average market weight from 230 to 240 pounds increases net returns by \$15,325 including the cost of additional finishing floor capacity.

### Effects of Market Prices

Each \$1.00 per cwt. change in the average price received for hogs changes the expected net returns by \$21,327. Based on these figures, with corn at \$2.65 per bu. and soybean meal at \$11.25 per cwt., a market hog price of \$44.61 (or an average price of \$44.30 per cwt. of all swine sold) is needed to pay total costs including land rent and management. This is with an overall feed conversion of 3.5 lb. of feed per lb. of swine sold and with all other costs as shown in the preceding budget (Table 4). Each \$0.10 per bu. increase in corn price reduces net returns by \$10,345. Each \$0.10 per cwt. increase in soybean meal price reduces net returns by \$1,195. An increase of \$1.00 per hour in average wage rate reduces net returns by \$10,000. A decrease from 12% to 11% in interest rate increases net returns by \$13,447.

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

Item	Total	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July
<b>Estimated cash receipts</b>													
1021 market hogs (230 lbs. @ \$47/cwt.)	110,370	0	0	0	0	0	0	0	0	0	0	36,754	73,616
33 cull gilts (300 lbs. @ \$42/cwt.)	4,158	504	504	504	504	630	504	126	252	126	126	126	252
119 cull sows (425 lbs. @ \$38/cwt.)	19,219	0	0	485	485	646	808	2,584	3,230	2,423	2,584	3,392	2,584
8 cull boars (500 lbs. @ \$30/cwt.)	1,200	0	150	150	0	0	150	150	150	0	150	150	150
<b>Total estimated cash receipts</b>	<b>134,947</b>	<b>504</b>	<b>654</b>	<b>1,139</b>	<b>989</b>	<b>1,276</b>	<b>1,462</b>	<b>2,860</b>	<b>3,632</b>	<b>2,549</b>	<b>2,860</b>	<b>40,422</b>	<b>76,602</b>
<b>Estimated cash expenses</b>													
Sow and boar feed	49,864	1,097	1,965	2,793	3,559	5,479	4,670	4,664	5,819	4,661	4,666	5,833	4,658
Pig creep feed	11,646	0	0	0	0	0	97	1,050	2,100	2,100	2,100	2,100	2,100
Pig feed 18% starter	23,477	0	0	0	0	0	0	3,276	3,848	3,848	4,810	3,848	3,848
Pig feed 16% grower	47,961	0	0	0	0	0	0	167	4,002	9,159	13,320	10,656	10,657
Hog feed 14% finisher	33,746	0	0	0	0	0	0	0	0	211	7,388	12,653	13,494
Feed additives	6,330	150	175	200	200	225	225	250	475	750	950	1,365	1,365
Electricity & fuel	21,760	960	1,200	1,200	1,200	1,400	1,900	2,100	2,200	2,400	2,400	2,400	2,400
Vet. & medication	7,430	200	200	200	300	400	550	550	750	950	1,050	1,140	1,140
Repairs	14,865	400	600	800	1,050	1,150	1,250	1,350	1,450	1,550	1,650	1,750	1,865
Truck expenses	12,070	500	500	500	500	500	750	1,000	1,200	1,400	1,500	1,860	1,860
Insurance and taxes	14,855	495	495	495	495	495	495	495	495	495	495	495	9,410
Miscellaneous	9,666	800	800	800	800	800	800	811	811	811	811	811	811
<b>Total estimated cash expenses</b>	<b>253,670</b>	<b>4,602</b>	<b>5,935</b>	<b>6,988</b>	<b>8,104</b>	<b>10,449</b>	<b>10,737</b>	<b>15,713</b>	<b>23,150</b>	<b>28,335</b>	<b>41,140</b>	<b>44,911</b>	<b>53,608</b>
<b>Breeding stock purchases</b>													
Boars @ \$575/head	19,550	14,375	575	0	0	575	575	575	575	575	575	575	575
Gilts @ \$200/head	126,800	27,000	20,400	20,000	18,400	19,400	3,600	3,600	4,400	3,600	3,600	2,800	0
Labor	46,195	3,085	3,085	3,085	3,085	3,085	3,600	3,600	4,285	4,285	5,000	5,000	5,000
<b>Inter./long term loan payments:</b>													
- principal	43,950	0	0	0	0	0	0	0	0	0	0	0	43,950
- interest	118,854	0	0	0	0	0	0	0	0	0	0	0	118,854
<b>Net monthly cash flow</b>	<b>(474,072)</b>	<b>(48,558)</b>	<b>(29,341)</b>	<b>(28,935)</b>	<b>(28,601)</b>	<b>(32,233)</b>	<b>(17,050)</b>	<b>(20,627)</b>	<b>(28,778)</b>	<b>(34,246)</b>	<b>(47,455)</b>	<b>(12,864)</b>	<b>(145,358)</b>
<b>Cumulative cash flow</b>	<b>(474,072)</b>	<b>(48,558)</b>	<b>(77,899)</b>	<b>(106,834)</b>	<b>(135,435)</b>	<b>(167,668)</b>	<b>(184,717)</b>	<b>(205,344)</b>	<b>(234,122)</b>	<b>(268,368)</b>	<b>(315,823)</b>	<b>(328,687)</b>	<b>(474,072)</b>
<b>Ending loan balances</b>													
Operating loans	474,072	48,558	77,899	106,834	135,435	167,668	184,717	205,334	234,122	268,368	315,823	328,687	474,072
Accrued int. on op. loan	20,735	0	486	1,265	2,333	3,687	5,364	7,211	9,265	11,606	14,289	17,448	20,735
Int./long term loans	946,498	990,448	990,448	990,448	990,448	990,448	990,448	990,448	990,448	990,448	990,448	990,448	946,498
<b>Total debt</b>	<b>1441305</b>	<b>1039006</b>	<b>1069932</b>	<b>1098546</b>	<b>1128216</b>	<b>1161803</b>	<b>1180529</b>	<b>1203003</b>	<b>1233853</b>	<b>1270422</b>	<b>1320561</b>	<b>1336583</b>	<b>1441305</b>



MSU is an Affirmative-Action, Equal-Opportunity Institution. Cooperative Extension Service Programs are open to all without regard to race, color, national origin, sex or handicap. Issued in furtherance of Cooperative Extension work in agriculture and home economics, acts of May 8, and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Michael J. Tate, interim director, Cooperative Extension Service, Michigan State University, E. Lansing, MI 48824