MP466

Arkansas Catfish Production Budgets

Cooperative Extension Program,
University of Arkansas at Pine Bluff,
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Contents

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Introduction

Arkansas is the second leading catfish-producing state in the U.S. Budgets to estimate costs of production provide guidance to farmers on the overall cost structures on catfish farms, the magnitude of costs and variation due to farm size. Production budgets are enterprise budgets that detail the expected revenue from sales of catfish and itemize the costs anticipated to be incurred during the production process.

Most enterprise budgets that have been developed for aquaculture enterprises, including catfish, have relied upon an approach termed "economic engineering." In economically engineered budgets, the values used are selected based on values that may be averages from research experiments or those commonly believed by extension personnel to be achievable with recommended practices. Frequently, the selection of quantities of inputs and yields is based on research studies or from the few databases available on commercial production, such as the Arkansas Catfish Research Verification Program. Farm sizes for aquaculture budgets frequently are based on convenient sizes of farms. However, budgets for other types of agricultural crops and livestock production are typically based on survey data. The U.S. Department of Agriculture conducts periodic cost of production surveys for various agricultural crops but not for aquaculture. Thus, there is no national database from which to develop enterprise budgets for aquaculture.

A survey of the catfish industry in Chicot County (Arkansas) was conducted in 2002. This is the first cost of production survey completed for the catfish industry. While the data are from only one county in one state, 44 farmers participated in the survey. Chicot County contains the greatest concentration of catfish farms in Arkansas. The data from this survey form the basis for the selection of farm sizes, the basic cost structures and the equipment inventory used in these budgets.

Enterprise Budgets

Farm Sizes

The farms surveyed ranged in size from 42 to 1,480 acres. However, statistical analysis revealed farm size thresholds at which the structure of use of certain inputs, such as labor, changed. These groupings fall into the following categories: less than 100 acres, 100-200 acres, 200-300 acres, 300-800 acres and above 800 acres. On the smallest farm sizes (less than 100 acres), labor was provided almost exclusively by family members (Table 1). Farms in the size range of 100-200 acres typically had either two full-time workers for part of the year or one worker part-time over the entire year in addition to family labor and perhaps some additional hourly labor. Farms in the next size range, from 200-300 acres, tended to hire full-time workers and some part-time labor along with family labor. Larger farms, in the size range of 300-800 acres, hired managers or foremen in addition to the full-time positions used for feeding, nighttime oxygen measurements and bird control as well as part-time or seasonal helpers for mowing and other tasks. Family members typically were involved in management and contributed less direct labor on the larger farm sizes. In the largest farm size category, one manager was typically hired to oversee the entire operation with foremen to manage individual blocks of ponds along with the other types of positions described above for the 300- to 800-acre farm size category.

Given these structural differences in labor and management, budgets were developed for each of these scenarios. The average farm size within each group was used to formulate budgets for farms of 60 acres, 131 acres, 256 acres, 431 acres and 1,007 acres. The quantities used in each budget were the averages from each group of farms reporting in the survey.

Yields

The yields reported in the survey were highly variable from year to year and from farm to farm. Farm-wide yields reported ranged from 1,000 to 7,000 lb/acre/year. However, there were no statistical differences in yield due to farm size. Thus, for these budgets, an average yield of 4,500 lb/acre/year was assumed. Sensitivity analyses were conducted to demonstrate the effect of yield variations ranging from 1,000 to 7,000 lb/acre on costs and returns from catfish farming.

Farming System

The survey indicated a great deal of variation in farming practices. Stocking rates ranged from 1,200 to 10,000 fish per acre of water, and the size of fish stocked varied from 2 to 8 inches. The higher stocking rates did not necessarily correspond to smaller sizes of fish. No statistically significant relationship could be estimated between yields and stocking rates. Part of the reason for this is the large amount of variation in a number of these practices. The average stocking rate of 5,690 fish per acre was used in the budgets, given that no difference in stocking rate due to farm size could be estimated.

While the farmers surveyed stocked a wide range of sizes of fish, the most commonly reported fish size stocked was 4 to 6 inches. The budgets were based on the average fingerling size of 5 inches.

The quantity of feed fed varied also, from 1.2 to 7.9 tons per growout acre, but was not significantly different due to farm size. Thus, the average quantity of feed fed used in the budgets was 4.78 tons per growout acre.

Equipment

The type and quantity of equipment used on farms also varied widely. Some farms had hatcheries while others did not. Some farms had seining equipment while others did not. Some individual farms used much more equipment than did other farms. In spite of the variability, there were some general patterns across the different farm size groupings. All farms had tractors, trucks, a mower, electrical aerators, PTO aerators, a feeder, feed bins, at least one pump and some shop tools. The 100- to 200-acre farms and the larger farms also had a utility trailer, storage container or building, an oxygen meter, a computer and at least one generator. Farms that were 300 acres or larger also had at least one shed, electric panel boxes, a fish loader, digital scales, a storage building and a house trailer for a manager or foreman. The largest farm sizes (over 800 acres) had radios, rifles and some heavy equipment like a backhoe.

A table summarizing the equipment costs used in the budgets is included in the appendix (Appendix Table 1). This table was compiled based on the equipment most commonly found within each size grouping.

Fish Price and Gross Receipts

The price of fish used in the budgets was the 10-year average price of catfish, $0.70/lb. Gross receipts were $3,150/acre, and total gross farm receipts ranged from $189,000 to $3,172,050 (Tables 2-6).

Variable Costs

Feed is the single largest cost in catfish production. Feed costs were $1,087 per acre across the budgets with total feed costs ranging from $65,218 to $1,094,581. Feed costs comprised from 45 percent to 47 percent of total variable costs, with the percentage decreasing with farm size. As a percent of total costs, feed costs were 33 to 36 percent. Fingerling costs, the second greatest cost in catfish production, were 12 percent of total variable costs and 9 percent of total costs. The next greatest variable costs on the two smallest farm sizes were seining and hauling costs, electricity, interest on operating capital and labor. Labor became the fifth most important cost on the 200- to 300-acre farm. On farms larger than 300 acres, labor became the third highest production cost followed by seining and hauling and interest on operating capital.

Fixed Costs

The primary fixed costs were interest on the capital investment and annual depreciation. Depreciation is not a cash expense, but it must be accounted for to ensure that the business earns sufficient profits to replace equipment and other investment items when they wear out. Interest on the capital investment must be accounted for even if there are no loans, because the capital used could have been invested elsewhere to earn revenue. Thus, the revenue not earned is "lost" to the individual. Net returns were calculated both with all expenses (both cash and non-cash) and with subtracting out only the cash expenses. Ownership, or fixed, costs represented from 19 to 23 percent of the total costs of producing catfish, depending on the farm size. The larger farms had lower ownership costs as a percentage of their total costs of production.

Net Returns

Net returns were calculated both without the costs of unpaid family labor and management and with the opportunity costs of unpaid family labor and management. Without accounting for the cost of unpaid family labor and management, net returns were $49, $86, $144, $158 and $145 per acre for the 60-acre, 131-acre, 256-acre, 431-acre and 1,007-acre farms, respectively (Figure 1). The decline in net returns per acre between the 431- and 1,007-acre farms is due to hiring an overall manager in addition to foremen or managers for each farm unit on this largest farm size. When values for the unpaid family labor and management were included, net returns decreased and became negative on the 60-acre and 131-acre farms. Across farm sizes, net returns above all costs increased as farm size increased, from -$161/acre to $111/acre on the largest farm size. This set of net returns is the true economic returns because all resources used in the production of catfish are accounted for.

Figure 1 contrasts the three measures of "profit." Without accounting for the costs of all equipment, labor and other non-cash costs, all farm scenarios appear to be very profitable. However, when properly accounting for the use of all equipment, labor and other inputs, the 60-acre and 131-acre farms were not profitable. The other three farm sizes showed modest profit levels.

Breakeven Prices and Yields

Breakeven prices to cover all costs of production decreased with increasing farm size, from $0.74/lb on the 60-acre farm to $0.68/lb on the 1,007-acre farm. This decrease in breakeven price, or unit cost of production, as farm size increases shows economies of scale throughout the farm size ranges analyzed.

Breakeven yields to cover all costs of production ranged from 4,729 lb/acre on the smallest farm size to 4,342 lb/acre on the largest farm size.

Sensitivity Analyses

Yields

Figure 2 presents the response of net returns above risk to yields from 3,500 to 5,500 lb/acre/year, and Appendix Table 2 shows net returns over a wider range of yields, from 1,000 to 7,000 lb/acre/year, with and without family labor and above cash costs. Results vary by farm size as would be expected, given the economies of scale demonstrated in the budgets. On the 1,007-acre and 431-acre farms, the farms were still profitable at 4,400 lb/acre (Figure 2). For the 256-acre farm, yields needed to be 4,500 lb/acre and above to be profitable, whereas the 131-acre farm needed yields to be at least 4,700 lb/acre/year. The 60-acre farm needed yields to be at least 4,800 lb/acre to be profitable, when all costs (including all operator's labor and management) were accounted for. Without considering unpaid family labor on the smallest farm size, farms needed to produce 4,500 lb/acre/year. For each 100 lb/acre increase in yield, net returns per acre increased by $64/acre across all farm sizes.

Feed Prices

Net returns decreased with increasing feed prices, as would be expected (Figure 3). Smaller farms became profitable at feed prices of $200/ton. For each $10 increase in feed price (per ton), net returns decreased by $52/acre across all farm sizes. Net returns/acre were positive on the 60-acre farm at feed prices of $190/ton and below and at $210/ton and below for the 131-acre farm. For the 256-acre farm, net returns/acre were positive at feed prices of $230/ton and below, and at $240/ton and below for the 431-acre and 1,007-acre farms.

An additional sensitivity analysis was conducted to compare costs from feeding 28 percent protein as compared to 32 percent protein. Over the last six years, 28 percent protein catfish feed has cost about $9.50/ton less than the cost of 32 percent protein feed. This results in a decreased cost of production of about $45/acre ($49, if the increase in interest on operating capital is included) or $0.01/lb of catfish produced.

Feed Conversion Ratios

Figure 4 demonstrates the effect of varying feed conversion ratios (FCR) on net returns. Decreased feed conversion ratios increased net returns, as expected. Net returns were positive at feed conversion ratios of 2.3 on the 1,007-acre farms but were positive only at 2.2 and below for the 256-acre and 431-acre farms, 1.9 for the 131-acre farm, and 1.8 for the 60-acre farm. For each decrease of 0.1 in feed conversion ratio, net returns increased by $56/acre across all farm sizes. These estimates were based on the average yields of 4,500 lb/acre/year.

Electric Rates

Over the 25-year period from 1980-2004, electric rates have fluctuated by about +10 percent above and below the 25-year average (Appendix Figure 1). However, electric rates in 2005 were 21.3 percent above the 25-year average. For this sensitivity analysis, electric rates were varied by +30 percent to bracket the range of values observed over this 25-year period as well as the continued increase into 2006 (Figure 5). For each 5 percent increase in electric rates, net returns decreased by $12/acre for the smaller farm sizes and $9/acre across the larger farm sizes (431 and 1,007 acres). The 2004 prices were 4.2 percent higher than the prices used in these budgets, and the 2005 prices were 10.7 percent higher than the budget prices. Thus, electric costs have increased catfish production costs by about $18-$24/acre above the budgeted costs or by about $0.004/lb.

Gas and Diesel Prices

Gas and diesel prices varied by +22 percent from 1980-2004 and were 32.2 percent above the 25-year average in 2005. For the sensitivity analysis, gas and diesel rates were varied by +70 percent and -40 percent, in increments of 10 percent (Figure 6). For each 10 percent increase in gas and diesel prices, net returns decreased by $8/acre across all farm sizes. The 2005 increase resulted in a decrease of $56/acre above the values used in these budgets or about $0.012/lb.

With Fry or Fingerling Ponds

The basic budgets were standardized to allow for comparisons across farm sizes. One of these standardizing assumptions was that farms purchased all the fingerlings stocked on the farm. However, in the survey, data showed that the majority of farms had fingerling ponds (63 percent of the 100- to 200-acre farms, 60 percent of the 200- to 300-acre farms, 89 percent of the 300- to 800-acre farms and 75 percent of the farms with greater than 800 acres), while 43 percent of the farms with less than 100 acres had fingerling ponds. Those with fingerling ponds used from 4 to 29 percent of the total farm acreage to produce fingerlings. Budgets were developed to evaluate the economics of purchasing fingerlings versus on-farm production of fingerlings from purchased fry.

The majority of farmers who raised fingerlings on-farm fed primarily pelleted feed used for foodfish production. A few of the smaller-scale farmers purchased some meal for fry ponds, switching later to regular pellets. Only one farm used a small (1/8th inch) pellet for fingerlings following some feeding with meal.

The profitability of on-farm production of fingerlings varied with the farm size and the percentage of growout area converted to fingerling production (Table 7). One of the largest costs associated with purchasing fry to raise to fingerlings is the pond space that is no longer available to grow out foodfish. For the 60-acre and 131-acre farms, it was only profitable to raise fingerlings on-farm at 4 percent of the growout area converted to fingerlings. If a larger percentage of the pond area is needed for fingerling production, the overall farm operation would not be profitable. It should be noted that on-farm production of fingerlings at 4 percent of the pond area did make the farm operation profitable. For the 256-acre farms, for on-farm fingerling production to be profitable, less than 14.5 percent of the farm had to be converted to fingerlings. All percentages of growout area converted to fingerlings were profitable for the largest farm sizes, but profit levels decreased with increasing percentages of growout area converted. Cost may not be the only consideration in terms of choosing to allocate growout ponds to fingerling production. Cash flow and other considerations must be taken into account before making the decision. Overall, net returns were higher with on-farm production of fingerlings than from fry purchased from hatcheries.

With a Hatchery

Adding a hatchery to a farm adds investment capital and annual depreciation costs. An additional 3 percent of the pond acreage would be taken out of production to maintain the broodstock. This acreage would consist of 2 acres, 4 acres, 8 acres, 13 acres and 30 acres removed from growout production for the 60-acre, 131-acre, 256-acre, 431-acre and 1,007-acre farms, respectively. The average 7.5 percent of acreage in fingerling production (identified in the survey data) was assumed.

The addition of a hatchery decreased net returns across all farm sizes. With the additional fixed costs, net returns for the 60-acre farm decreased from -$3,438 (net returns with fingerling growout ponds in place) to -$6,828. Net returns for the 131-acre farm also decreased from -$1,064 to -$1,963. For the 256-acre farm, the $37,662 net returns decreased to $32,434. For the 431-acre farm, net returns of $75,130 decreased to $68,453. For the 1,007-acre farm, net returns decreased from $195,283 to $185,124. This analysis did not demonstrate economic benefit from adding a hatchery to the farm business.

Hiring a Seining Crew Compared to Using Custom Seining

Another standardizing assumption used for the base budgets was that farms did not have seining crews but contracted custom harvesters for all their seining and hauling. A partial budget was developed to examine whether it was more or less profitable to hire a crew for on-farm seining than to use custom harvesters for the various farm sizes.

To do their own seining, farmers would need to purchase the equipment needed (seine, seine reel, boat, trailer, motor and fish loader) and have an adequate amount of labor available. The seining equipment would cost about $13,100 with an annual depreciation of about $1,588. The smaller farm sizes would need only one set of equipment. On the 431-acre farm, one full-time seining crew could handle seining each pond twice a year. However, to seine three times a year would require a second seining crew. The 1,007-acre farm would need three sets of seining equipment and crew under these assumptions.

Table 8 itemizes the additional labor that would be required to do all the seining on-farm. Ponds were assumed to be 10 acres each. Seining was assumed to require six people all together. The number of additional workers required was obtained by subtracting the number of individuals available (including unpaid family labor) from the six required. Ponds were assumed to be seined either two times a year or three times a year. It was also assumed that a working day was 10 hours/day. The additional labor was valued at $6.50/hour.

Hiring enough full-time permanent employees to provide for on-farm seining appears to be possible only on the two largest farm sizes, 431 acres and 1,007 acres (Table 8). The 60-acre farm, for example, would need to hire 4.5 additional workers but would only need 720 hours of labor for seining. Hiring 4.5 full-time individuals will provide 2,600 hours of labor a year from each worker, or 11,700 hours a year, but only 720 hours are needed for seining if ponds are seined twice a year (1,080 hours if seined three times a year). There would be enough seining work to justify hiring the additional people needed for seining only on the 431-acre and 1,007-acre farms. Smaller farm sizes may be able to hire hourly labor as needed if there is an adequate local pool of labor. Similarly, for

the 131-acre farm, four additional workers would be needed, but only 1,560 hours of labor are needed. In areas of labor shortages, the smaller-scale farms may need to depend on custom harvesters.

Table 9 presents the partial budgets developed to estimate the total net benefit of switching to on-farm seining from custom harvesting. There was no additional revenue. There would be the reduced cost of $0.02/lb of fish harvested that would no longer be paid to the custom harvester. Hauling cost of $0.03/lb would continue to be charged. The additional costs consist of the annual depreciation on the seining equipment (seine, seine reel, boat, trailer, motor and fish loader), interest on the investment in the additional equipment (to account for either an additional equipment loan or the value of using that capital for something else) and the additional labor. There was no reduced revenue. An on-farm seining crew was assumed to be as proficient at seining as a custom harvester. The total additional costs increased from $7,578 to $86,694 as farm size increased.

Total net benefits (total additional revenue − total additional costs) were negative for the two smallest farm sizes (60 and 131 acres). It was more profitable for the larger farm sizes to hire seining crews. Thus, based strictly on costs, it was more profitable for the smaller farms to use custom harvesters. However, there may be other reasons for on-farm seining, depending on markets and management strategies.

These results will vary with yields on the farm. The more fish that are seined on the farm, the less the cost per pound of hiring a seining crew. Table 9 also indicates how high yields would have to be on the various farm sizes to justify the additional costs associated with on-farm seining. These ranged from 6,322 lb/acre for the 60-acre farm to 4,375 lb/acre for the 256-acre farm. Farms with yields higher than these breakeven yields may find it more profitable to switch to on-farm seining, if they can find appropriate amounts of labor. On the 60-acre farm, for example, this would mean being able to hire hourly labor as needed for seining events.

Leasing Versus Owning Ponds

Some catfish farms are leased. The base budgets assumed that all ponds were constructed and owned by the farm. Lease rates, in the survey data, ranged from $170/acre/year to $300/acre/year. Most of the lease rates reported in the survey were about $200/acre. The budgets were modified by adding the lease rate as an operating cost and removing the fixed costs associated with depreciation and interest on investment of constructing the ponds and water supply system.

When all labor was accounted for and costed out, at all lease rates considered, catfish production continued to be unprofitable for the 60-acre farm (Table 10). At lease rates less than $250/acre, the losses were less than when constructing and owning all ponds. For the 131-acre farm, net returns were positive for lease rates of $100/acre and became unprofitable (with greater losses than the base scenario with pond ownership) at lease rates of $150/acre, at $300/acre for the 256-acre farm and at $350/acre for the 431-acre farm and the 1,007-acre farm. Leasing ponds was more profitable than ownership for the 256-acre farm at rates of $200/acre and less. Lease rates above $200/acre were less profitable than ownership for all farm sizes. It should be noted, however, that there may be cash flow or other reasons to lease ponds. Similarly, pond ownership provides increasing equity for the farm business, enhances the balance sheet and contributes to owner wealth.

At the lease rate of $200/acre/year, net returns without accounting for unpaid family labor and management were profitable across all farm sizes and ranged from $78/acre/year (60-acre farm) to $182/acre/year (431-acre farm). Leasing became unprofitable at a rate of $300/acre/year on the 60-acre farm but remained positive across all lease rates for the other farm sizes, as long as unpaid family labor and management were not accounted for.

Conclusions

Catfish farming is a profitable venture under a variety of conditions. Economies of scale are evident, but there are a variety of ways to manage a catfish farm successfully. For example, the analysis showed that the 60-acre farm, with average yields, FCR and feed prices, was not profitable. Higher yields, lower FCR and/or lower feed prices could result in profits even on this small scale. However, when planning a business, it is critical to account for the fluctuations in prices and values over time. Also, if higher yields are possible only with increased costs, these must be added to the budgets.

It is important to analyze the specific costs for each particular farming business. Spreadsheets (Excel) of these budgets are available for download and can be used to enter specific costs for your particular catfish farm. These can be found at the following web address: http://uaex.edu/cengle/.

Figure 1. Net returns/acre for various farm sizes

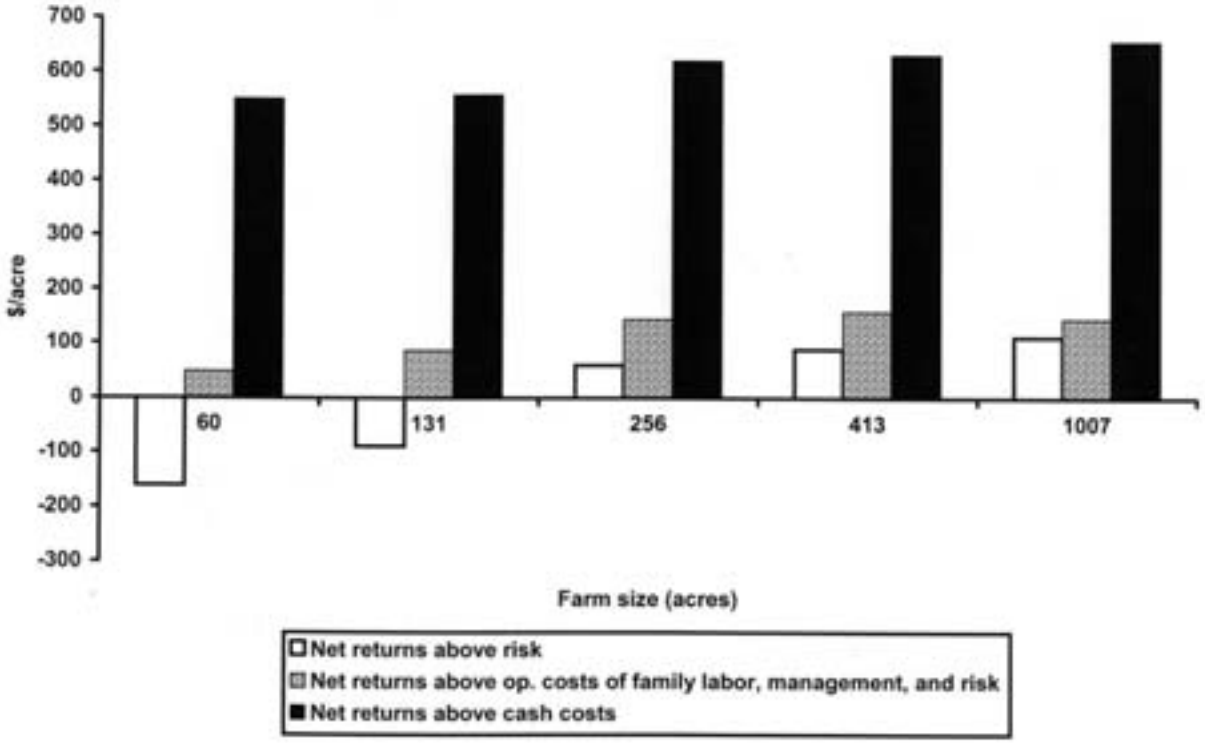

Figure 2. Sensitivity of net returns/acre to varying yields

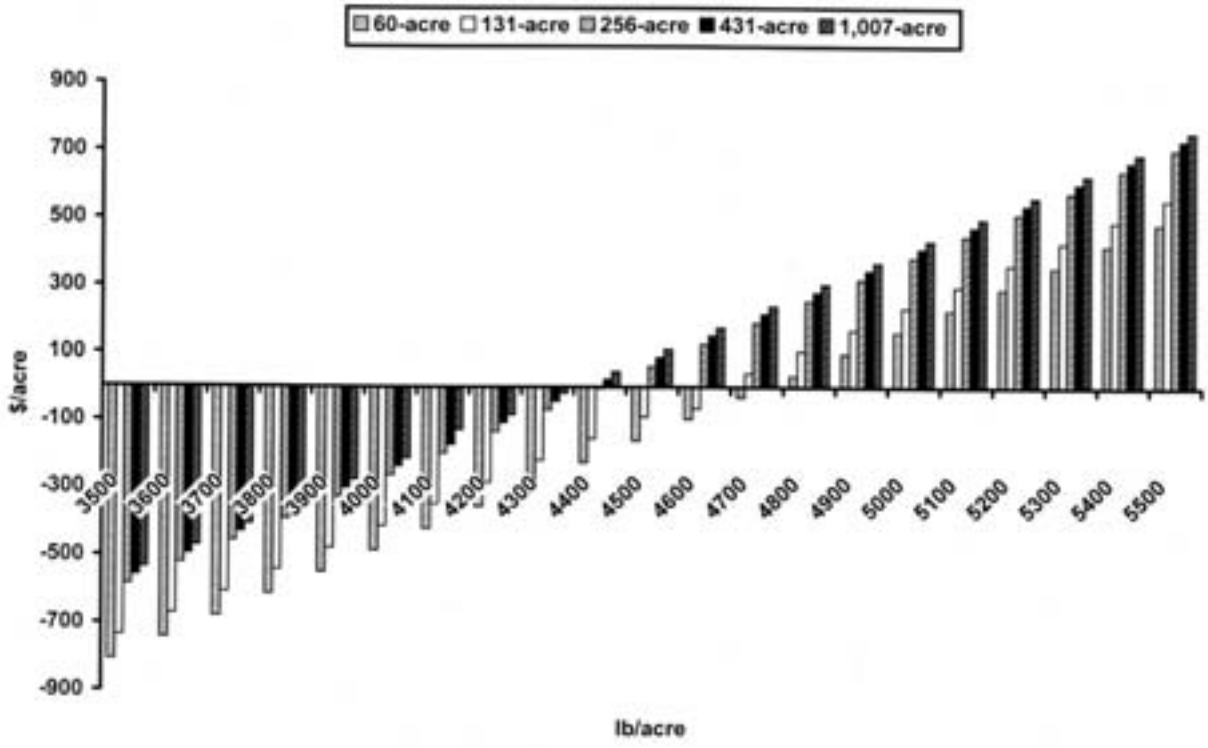

Figure 3. Sensitivity of net returns/acre to varying feed prices

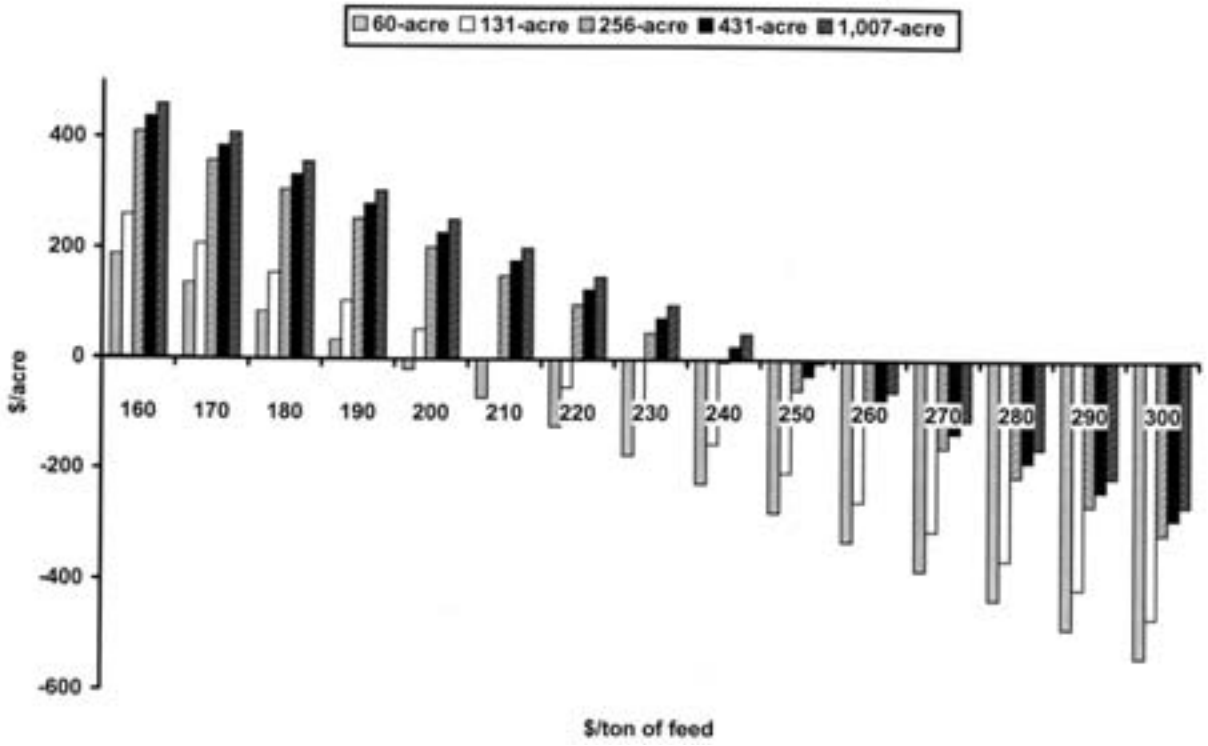

Figure 4. Sensitivity of net returns/acre to varying FCR

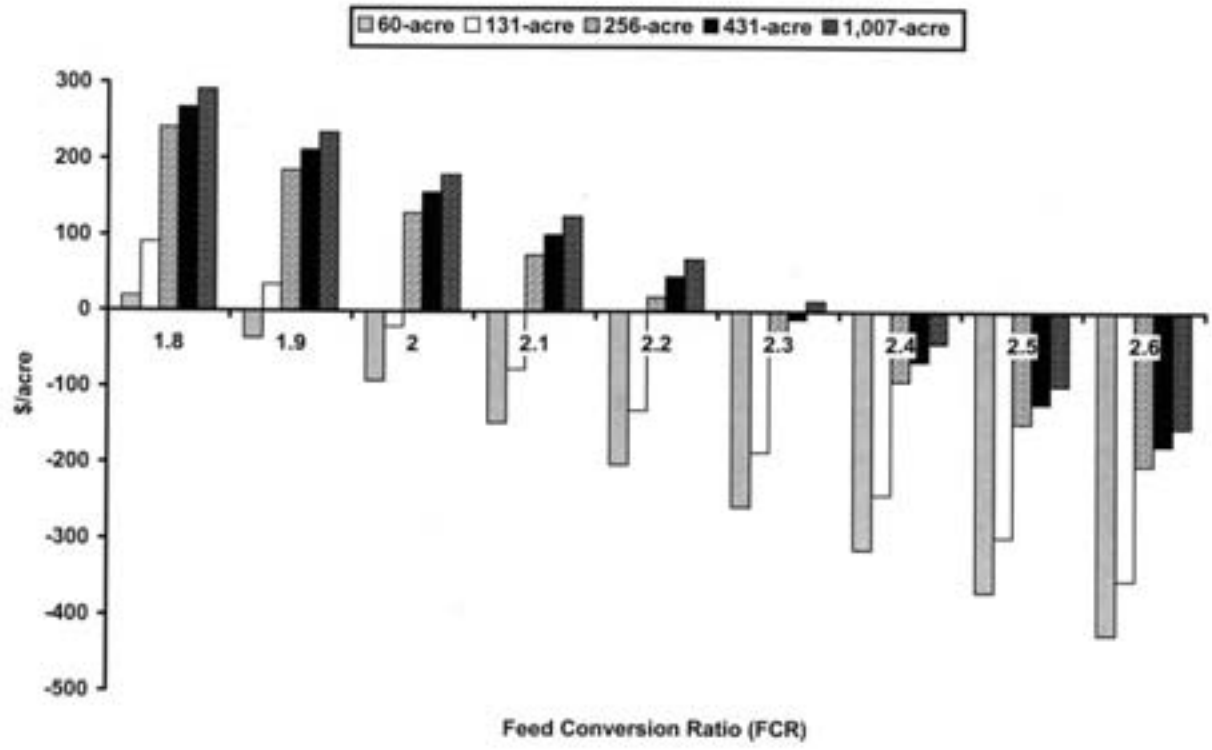

Figure 5. Sensitivity of net returns/acre to varying electric rates

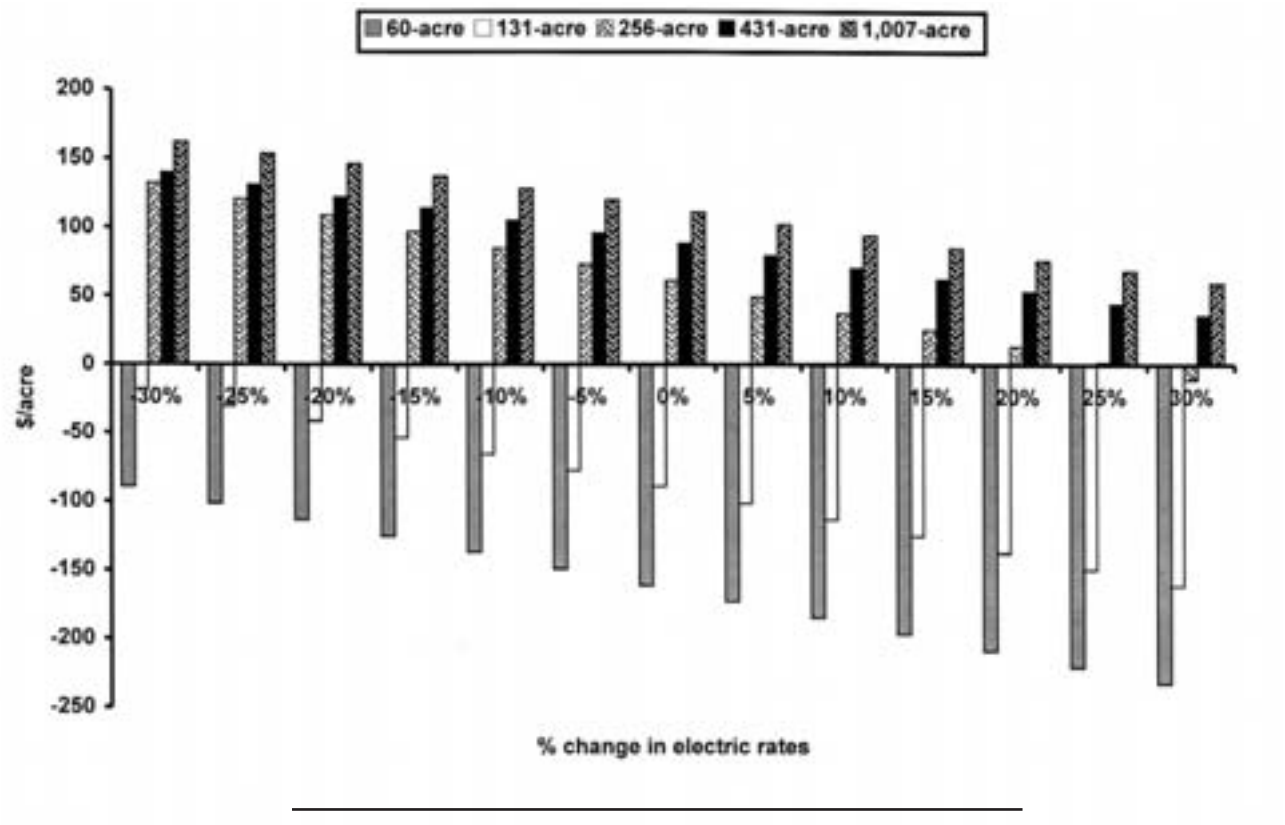

Figure 6. Sensitivity of net returns/acre to varying rates of gas/diesel

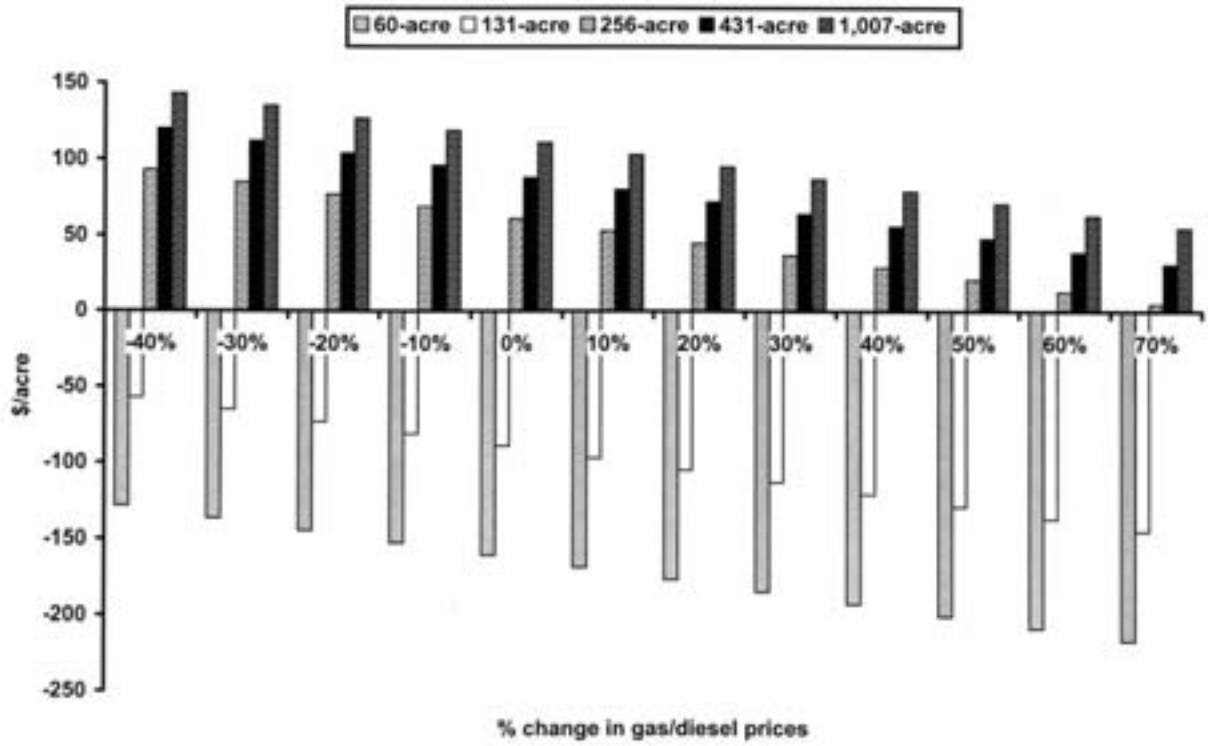

Table 1. Labor, means and ranges from survey, Chicot County, Arkansas, 2002

	<100 acres	100-200 acres	200-300 acres	300-800 acres	>800 acres
Survey data					
Family members	1 ± 0.6	2.2 ± 1.4	1 ± 0.6	2.1 ± 1.5	1.75 ± 1.0
Hired full-time, year-round	0	1.5 ± 0.9	2 ± 1.4	3.9 ± 2.4	12 ± 8
Part-time, year-round	0.4 ± 0.5	2.4 ± 0.9	1 ± 0	1.4 ± 0.9	11 ± 13
Seasonal, full-time	0	1.0 ± 0.0	1.0 ± 0.0	2.0 ± 1.7	2.8 ± 2.9
Seasonal, part-time	0	0	0	2.0 ± 0.0	5 ± 0.0
Used in budgets					
Family members	1	1	1	1	1
Hired full-time, year-round	0	1	2	3	9
Part-time, year-round	0.4	0	0	0	0
Seasonal, full-time	0	0	0	0.75	0
Seasonal, part-time	0	0	0.5	1	2

Table 2. Enterprise budget for a 60-acre catfish farm

(stocking 5,690 4- to 6-inch fingerlings/acre; feed fed at 4.78 tons/acre/year; yield of 4,500 lb/acre; fingerlings purchased off-farm; ponds owned by farmers)

Item	Description	Unit	Quantity	Price/Cost	Total
Gross receipts	catfish foodfish	lb	270,000	0.70	**189,000**
Variable costs					
Feed	32% protein floating	ton	286.80	227.40	65,218
Fingerlings	5-inch	inch	1,707,000	0.010	17,070
Labor	part-time	FTE[a]	0.4	16,608	6,643
Plankton control	empirical average[b]	acre	60	14.40	864
Gas and diesel	empirical average[b]	acre	60	74	4,440
Electricity	empirical average[b]	acre	60	222	13,320
Repairs and maintenance	empirical average[b]	acre	60	97	5,820
Bird depredation supplies		acre	60	6.25	375
Seining and hauling	catfish foodfish	lb	270,000	0.05	13,500
Telephone	empirical average[b]	acre	60	17	1,020
Office supplies	empirical average[b]	acre	60	11	660
Interest on operating capital		$	107,442[c]	0.10	10,744
Total variable costs					**139,674**
	per acre				2,328
Income above variable costs					**49,326**
Fixed costs					
Farm insurance	empirical average[b]	acre	60	43.6	2,616
Legal/accounting	empirical average[b]	acre	60	18.80	1,128
Investment					
Land	empirical average[b]	$	49,320[d]	0.10	4,932
Wells	empirical average[b]	$	14,000[e]	0.10	1,400
Pond construction	empirical average[b]	$	83,880[f]	0.10	8,388
Equipment	empirical average[b]	$	138,100	0.10	13,810
Annual depreciation					
Equipment	empirical average[b]	acre	1	14,110	14,110
Total fixed costs					**46,384**
	per acre				773
Total costs					**186,058**
	per acre				3,101
Net returns to operator's labor, management and risk					**2,942**
	per acre				49

(continued on page 11)

Table 2. Enterprise budget for a 60-acre catfish farm (cont.)
(stocking 5,690 4- to 6-inch fingerlings/acre; feed fed at 4.78 tons/acre/year; yield of 4,500 lb/acre; fingerlings purchased off-farm; ponds owned by farmers)

Item	Description	Unit	Quantity	Price/Cost	Total
Opportunity costs					
Operator's labor	family	total	1	9,965	9,965
Operator's management	family	total	1	2,610	2,610
Total opportunity costs of family labor and management					12,575
Total costs					**198,633**
Net returns to operator's risk					**-9,633**
	per acre				-161
Non-cash costs					42,640
Net returns above cash (to operator's risk)					**33,007**
	per acre				550
Breakeven price	above variable costs				**0.52**
	above total costs				**0.74**
Breakeven yield	above variable costs				**199,534**
	per acre				3,326
	above total costs				**283,761**
	per acre				4,729

[a] FTE = Full-time equivalent. One person working one 10-hour day is 1 FTE. Two people working 5-hour days is 1 FTE.
[b] From survey data.
[c] Operating capital was assumed to be used for 10 months of the year.
[d] Land values = $822/acre.
[e] Two wells at $7,000 each.
[f] Pond construction costs = $1,398/acre.

Table 3. Enterprise budget for a 131-acre catfish farm

(stocking 5,690 4- to 6-inch fingerlings/acre; feed fed at 4.78 tons/acre/year; yield of 4,500 lb/acre; fingerlings purchased off-farm; ponds owned by farmers)

Item	Description	Unit	Quantity	Price/Cost	Total
Gross receipts	catfish foodfish	lb	589,500	0.70	**412,650**
Variable costs					
Feed	32% protein floating	ton	626.18	227.4	142,393
Fingerlings	5-inch	inch	3,726,950	0.010	37,270
Labor	year-round, part-time	FTE[a]	1	17,794	17,794
Plankton control	empirical average[b]	acre	131	14.40	1,886
Gas and diesel	empirical average[b]	acre	131	74	9,694
Electricity	empirical average[b]	acre	131	222	29,082
Repairs and maintenance	empirical average[b]	acre	131	97	12,707
Bird depredation supplies		acre	131	6.25	819
Seining and hauling	catfish foodfish	lb	589,500	0.05	29,475
Telephone	empirical average[b]	acre	131	17	2,227
Office supplies	empirical average[b]	acre	131	11	1,441
Interest on operating capital		$	237,323[c]	0.10	23,732
Total variable costs					**308,520**
	per acre				2,355
Income above variable costs					**104,130**
Fixed costs					
Farm insurance	empirical average[b]	acre	131	43.6	5,712
Legal/accounting	empirical average[b]	acre	131	18.80	2,463
Investment					
Land	empirical average[b]	$	107,682[d]	0.10	10,768
Wells	empirical average[b]	$	21,000[e]	0.10	2,100
Pond construction	empirical average[b]	$	183,138[f]	0.10	18,314
Equipment	empirical average[b]	$	262,117	0.10	26,212
Annual depreciation					
Equipment	empirical average[b]	acre	1	27,271	27,271
Total fixed costs					**92,840**
	per acre				709
Total costs					**401,360**
	per acre				3,064
Net returns to operator's labor, management and risk					**11,290**
	per acre				86

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Table 3. Enterprise budget for a 131-acre catfish farm (cont.)
(stocking 5,690 4- to 6-inch fingerlings/acre; feed fed at 4.78 tons/acre/year; yield of 4,500 lb/acre; fingerlings purchased off-farm; ponds owned by farmers)

Item	Description	Unit	Quantity	Price/Cost	Total
Opportunity costs					
Operator's labor	family	each	1	17,794	17,794
Operator's management	family	each	1	5,217	5,217
Total opportunity costs of family labor and management					23,011
Total costs					**424,371**
Net returns to operator's risk					**-11,721**
	per acre				-89
Non-cash costs					84,665
Net returns above cash (to operator's risk)					**72,944**
	per acre				557
Breakeven price	above variable costs				**0.52**
	above total costs				**0.72**
Breakeven yield	above variable costs				**440,743**
	per acre				3,364
	above total costs				**606,244**
	per acre				4,628

[a] FTE = Full-time equivalent. One person working one 10-hour day is 1 FTE. Two people working 5-hour days is 1 FTE.
[b] From survey data.
[c] Operating capital was assumed to be used for 10 months of the year.
[d] Land values = $822/acre.
[e] Three wells at $7,000 each.
[f] Pond construction costs = $1,398/acre.

Table 4. Enterprise budget for a 256-acre catfish farm

(stocking 5,690 5-inch fingerlings/acre; feed fed at 4.78 tons/acre/year; yield of 4,500 lb/acre; fingerlings purchased off-farm; pond owned by farmers)

Item	Description	Unit	Quantity	Price/Cost	Total
Gross receipts	catfish foodfish	lb	1,152,000	0.70	**806,400**
Variable costs					
Feed	32% protein floating	ton	1,223.68	227.4	278,265
Fingerlings	5-inch	inch	7,283,200	0.010	72,832
Labor	year-round, full-time	FTE[a]	2	20,280	40,560
	seasonal or part-time	FTE	0.5	20,280	10,140
Plankton control	empirical average[b]	acre	256	14.40	3,686
Gas and diesel	empirical average[b]	acre	256	74	18,944
Electricity	empirical average[b]	acre	256	222	56,832
Repairs and maintenance	empirical average[b]	acre	256	97	24,832
Bird depredation supplies		acre	256	6.25	1,600
Seining and hauling	catfish foodfish	lb	1,152,000	0.05	57,600
Telephone	empirical average[b]	acre	256	10.50	2,688
Office supplies	empirical average[b]	acre	256	11.00	2,816
Interest on operating capital		$	475,663[c]	0.10	47,566
Total variable costs					**618,361**
	per acre				2,415
Income above variable costs					**188,039**
Fixed costs					
Farm insurance	empirical average[b]	acre	256	25.3	6,477
Legal/accounting	empirical average[b]	acre	256	6.1	1,562
Investment					
Land	empirical average[b]	$	210,432[d]	0.1	21,043
Wells	empirical average[b]	$	48,000[e]	0.1	4,800
Pond construction	empirical average[b]	dollars	357,888[f]	0.1	35,789
Equipment	empirical average[b]	dollars	387,570	0.1	38,757
Annual depreciation					
Equipment	empirical average[b]	acre	1	42,707	42,707
Total fixed costs					**151,135**
	per acre				590
Total costs					**769,496**
	per acre				3,006
Net returns to operator's labor, management and risk					**36,904**
	per acre				144

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Table 4. Enterprise budget for a 256-acre catfish farm (cont.)
(stocking 5,690 5-inch fingerlings/acre; feed fed at 4.78 tons/acre/year; yield of 4,500 lb/acre; fingerlings purchased off farm; pond owned by farmers)

Item	Description	Unit	Quantity	Price/Cost	Total
Opportunity costs					
Operator's labor	family	each	1	10,140	10,140
Operator's management	family	each	1	11,154	11,154
Total opportunity costs of family labor and management					21,294
Total costs					**790,790**
Net returns to operator's risk					**15,610**
	per acre				61
Non-cash costs					143,096
Net returns above cash (to operator's risk)					**158,706**
	per acre				620
Breakeven price	above variable costs				**0.54**
	above total costs				**0.69**
Breakeven yield	above variable costs				**883,373**
	per acre				3,451
	above total costs				**1,129,700**
	per acre				4,413

[a] FTE = Full-time equivalent. One person working one 10-hour day is 1 FTE. Two people working 5-hour days is 1 FTE.
[b] From survey data.
[c] Operating capital was assumed to be used for 10 months of the year.
[d] Land values = $822/acre.
[e] Six wells at $8,000 each.
[f] Pond construction costs = $1,398/acre.

Table 5. Enterprise budget for a 431-acre catfish farm

(stocking 5,690 5-inch fingerlings/acre; feed fed at 4.78 tons/acre/year; yield of 4,500 lb/acre; fingerlings purchased off-farm; ponds owned by farmers)

Item	Description	Unit	Quantity	Price/Cost	Total
Gross receipts	catfish foodfish	lb	1,939,500	0.70	**1,357,650**
Variable costs					
Feed	32% protein floating	ton	2,060.18	227.4	468,485
Fingerlings	5-inch	inch	12,261,950	0.010	122,620
Labor	manager/foreman	FTE[a]	1	28,000	28,000
	feedman/night/bird	FTE	2	24,000	48,000
	helper	FTE	0.75	22,000	16,500
	seasonal, part-time	FTE	1	20,280	20,280
Plankton control	empirical average[b]	acre	431	14.40	6,206
Gas and diesel	empirical average[b]	acre	431	74	31,894
Electricity	empirical average[b]	acre	431	161	69,391
Repairs and maintenance	empirical average[b]	acre	431	97	41,807
Bird depredation supplies		acre	431	6.25	2,694
Seining and hauling	catfish foodfish	lb	1,939,500	0.05	96,975
Telephone	empirical average[b]	acre	431	10.5	4,526
Office supplies	empirical average[b]	acre	431	11	4,741
Interest on operating capital		$	801,765[c]	0.10	80,177
Total variable costs					**1,042,296**
	per acre				2,418
Income above variable costs					**315,354**
Fixed costs					
Farm insurance	empirical average[b]	acre	431	25.30	10,904
Legal/accounting	empirical average[b]	acre	431	6.10	2,629
Investment					
Land	empirical average[b]	$	354,282[d]	0.10	35,428
Wells	empirical average[b]	$	81,000[e]	0.10	8,100
Pond construction	empirical average[b]	$	602,538[f]	0.10	60,254
Equipment	empirical average[b]	$	606,035	0.10	60,604
Annual depreciation					
Equipment	empirical average[b]	acre	1	69,407	69,407
Total fixed costs					**247,326**
	per acre				574
Total costs					**1,289,622**
	per acre				2,992
Net returns to operator's labor, management and risk					**68,028**
	per acre				158

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Table 5. Enterprise budget for a 431-acre catfish farm (cont.)
(stocking 5,690 5-inch fingerlings/acre; feed fed at 4.78 tons/acre/year; yield of 4,500 lb/acre; fingerlings purchased off-farm; ponds owned by farmers)

Item	Description	Unit	Quantity	Price/Cost	Total
Opportunity costs					
Operator's management	family	FTE	1	30,000	30,000
Total opportunity costs of family labor and management					30,000
Total costs					**1,319,622**
Net returns to operator's risk					**38,028**
	per acre				88
Non-cash costs					233,793
Net returns above cash (to operator's risk)					**271,821**
	per acre				631
Breakeven price	above variable costs				**0.54**
	above total costs				**0.68**
Breakeven tield	above variable costs				**1,488,994**
	per acre				3,455
	above total costs				**1,885,174**
	per acre				4,374

[a]FTE = Full-time equivalent. One person working one 10-hour day is 1 FTE. Two people working 5-hour days is 1 FTE.
[b]From survey data.
[c]Operating capital was assumed to be used for 10 months of the year.
[d]Land values = $822/acre.
[e]Nine wells at $9,000 each.
[f]Pond construction costs = $1,398/acre.

Table 6. Enterprise budget for a 1,007-acre catfish farm

(stocking 5,690 5-inch fingerlings/acre; feed fed at 4.78 tons/acre/year; yield of 4,500 lb/acre; fingerlings purchased off-farm; ponds owned by farmers)

Item	Description	Unit	Quantity	Price/Cost	Total
Gross receipts	catfish foodfish	lb	4,531,500	0.70	**3,172,050**
Variable costs					
Feed	32% protein floating	ton	4,813.46	227.4	1,094,581
Fingerlings	5-inch	inch	28,649,150	0.010	286,492
Labor	manager	FTE[a]	1	35,000	35,000
	foreman	FTE	2	28,000	56,000
	feed/night/bird	FTE	4	24,000	96,000
	helper	FTE	2	22,000	44,000
	seasonal/part-time	FTE	2	20,280	40,560
Plankton control	empirical average[b]	acre	1,007	14.40	14,501
Gas and diesel	empirical average[b]	acre	1,007	74	74,518
Electricity	empirical average[b]	acre	1,007	161	162,127
Repairs and maintenance	empirical average[b]	acre	1,007	97	97,679
Bird depredation supplies		acre	1,007	6.25	6,294
Seining and hauling	catfish foodfish	lb	4,531,500	0.05	226,575
Telephone	empirical average[b]	acre	1,007	10.5	10,574
Office supplies	empirical average[b]	acre	1,007	11	11,077
Interest on operating capital		$	1,879,982[c]	0.10	187,998
Total variable costs					**2,443,976**
	per acre				2,427
Income above variable costs					**728,074**
Fixed costs					
Farm insurance	empirical average[b]	acre	1,007	25.3	25,477
Legal/accounting	empirical average[b]	acre	1,007	6.1	6,143
Investment					
Land	empirical average[b]	$	827,754[d]	0.1	82,775
Wells	empirical average[b]	$	265,696[e]	0.1	26,570
Pond construction	empirical average[b]	$	1,407,786[f]	0.1	140,779
Equipment	empirical average[b]	$	1,471,171	0.1	147,117
Annual depreciation					
Equipment	empirical average[b]	acre	1	152,818	152,818
Total fixed costs					**581,679**
	per acre				578
Total costs					**3,025,655**
	per acre				3,005
Net returns to operator's labor, management and risk					**146,395**
	per acre				145

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Table 6. Enterprise budget for a 1,007-acre catfish farm (cont.)
(stocking 5,690 5-inch fingerlings/acre; feed fed at 4.78 tons/acre/year; yield of 4,500 lb/acre; fingerlings purchased off-farm; ponds owned by farmers)

Item	Description	Unit	Quantity	Price/Cost	Total
Opportunity costs					
Operator's management	family	FTE	1	35,000	35,000
Total family labor and management					35,000
Total costs					**3,060,655**
Net returns to operator's risk					**111,395**
	per acre				111
Non-cash costs					550,059
Net returns above cash (to operator's risk)					**661,454**
	per acre				657
Breakeven price	above variable costs				**0.54**
	above total costs				**0.68**
Breakeven yield	above variable costs				**3,491,394**
	per acre				3,467
	above total costs				**4,372,364**
	per acre				4,342

[a] FTE = Full-time equivalent. One person working one 10-hour day is 1 FTE. Two people working 5-hour days is 1 FTE.
[b] From survey data.
[c] Operating capital was assumed to be used for 10 months of the year.
[d] Land values = $822/acre.
[e] Twenty-three wells at $11,552 each.
[f] Pond construction costs = $1,398/acre.

Table 7. Effect of varying percentages of pond acreage put into fingerling production on net returns to operator's labor, management and risk

		Farm size				
	Units	60-acre	131-acre	256-acre	431-acre	1,007-acre
Net returns from baseline scenario	$	-$9,633	-$11,721	$15,610	$38,028	$111,395
Pond area stocked for fingerling production						
4	%	$1,094	$10,266	$58,057	$109,121	$276,861
7.5	%	-$3,438	-$1,064	$37,662	$75,130	$195,283
11	%	-$10,237	-$10,129	$17,268	$41,139	$115,971
14.5	%	-$14,769	-$21,459	-$3,127	$7,149	$36,659
29	%	-$32,897	-$52,814	-$86,971	-$135,463	-$294,735

Table 8. Labor requirements and value to add a seining crew to varying sizes of catfish farms

Farm size (acres)	Workers available on farm	Number of ponds[a]	Additional workers required for seining and available hours[b]		Labor required for seining and value			
	number		number	hours	Two times/year[c]		Three times/year[d]	
					hours	$[e]	hours	$
60	1.5	6	4.5	11,700	720	$4,689	1,080	$7,020
131	2	13	4	10,400	1,560	$10,140	2,340	$15,210
256	3	25	3	7,800	3,000	$19,500	4,500	$29,250
431	6	43	0	0	5,160	$33,540	7,740	$50,310
	6	100	6	15,600	5,160	$33,540	7,740	$50,310
1,007	14	100	4	10,400	12,000	$78,000	18,000	$117,000

[a] Assuming most ponds are 10 acres each in size.
[b] Seining crews are assumed to require 6 men each; 1 crew for 60-, 131-, 256- and 431-acre farms. A second crew would be needed to seine each pond three times per year on the 431-acre farm, and three crews would be needed for the 1,007-acre farm.
[c] 10 hours/day (2,080/8 hours/day = 260 workdays in a year) = 2,600 hours/year per worker. 6 men x 10 hours to seine, stake and load a pond once = 60 hours x 2 times/year = 120 hours/pond = 180 for 3 times/year.
[d] Seining three times a year would require a second seining crew.
[e] Labor is valued at $6.50/hour. Management is assumed to be present on farm.

Table 9. Partial budgets of switching from custom seining to on-farm seining

Partial budget category	Farm size (acres)				
	60	131	256	431	1,007
Additional revenue	0	0	0	0	0
Reduced costs[a]	$5,400	$11,790	$23,040	$38,790	$90,630
Total Additional Revenue	$5,400	$11,790	$23,040	$38,790	$90,630
Additional costs					
Annual equipment depreciation[b]	1,588	1,588	1,588	1,588	4,764
Interest, additional capital	1,310	1,310	1,310	1,310	3,930
Labor	4,680	10,140	19,500	33,540	78,000
Reduced revenue[c]	0	0	0	0	0
Total Additional Costs	$7,578	$13,038	$22,398	$36,438	$86,694
TOTAL NET BENEFITS	-$2,178	-$1,248	$642	$2,352	$3,936
Breakeven production (lb)[d]	379,350	651,900	1,119,900	1,966,800	4,479,600
Breakeven yield (lb/acre)	6,322	4,976	4,375	4,563	4,448

[a] $0.02/lb harvest charged by custom harvesters.
[b] Total cost of one set of equipment needed for seining is $13,100. This includes a seine, seine reel, boat, trailer, motor and a fish loader. The 431-acre farm will need one set if seining twice a year and two if seining three times a year. The 1,007-acre farm will need three sets of seining equipment.
[c] An on-farm seining crew is assumed to be equally proficient as a custom harvester.
[d] Divided additional costs by the $0.02/lb saved by on-farm seining. Assuming hiring the hours required to do all the seining and seining two times/year.

Table 10. Effect of varying lease rates on net returns to risk on various farm sizes

Lease rate	Farm size				
	60 acres	131 acres	256 acres	431 acres	1,007 acres
$100/acre	-$24	$41	$193	$220	$251
$150/acre	-$78	-$14	$139	$166	$197
$200/acre	-$132	-$68	$85	$112	$143
$250/acre	-$186	-$122	$31	$58	$89
$300/acre	-$240	-$176	-$23	$3	$34
$350/acre	-$294	-$230	-$77	-$51	-$20

Appendix

Appendix Table 1. Equipment list, from survey data

Item	Unit	<100 acres	100-200 acres	200-300 acres	300-800 acres	>800 acres
Tractors	number	4	6	7	11	34
Unit cost	$	18,000	20,000	20,000	12,000	17,000
Total cost	$	72,000	120,000	140,000	132,000	578,000
Useful life	year	20	20	20	20	20
Annual depreciation	$	3,600	6,000	7,000	6,600	28,900
Trucks	number	1	2	2	5	12
Unit cost	$	17,000	17,000	17,000	17,000	17,000
Total cost	$	17,000	34,000	34,000	85,000	204,000
Useful life	year	8	8	8	8	8
Annual depreciation	$	2,125	4,250	4,250	10,625	25,550
Mower	number	1	1	1	2	4
Unit cost	$	3,800	5,000	8,365	6,000	2,800
Total cost	$	3,800	5,000	8,365	12,000	11,200
Useful life	year	5	5	5	5	5
Annual depreciation	$	760	1,000	1,673	2,400	2,240
Electrical aerators	number	6	13	25	43	100
Unit cost	$	3,200	3,324	3,460	3,237	2,832
Total cost	$	19,200	43,212	86,500	139,191	283,200
Useful life	year	5	5	5	5	5
Annual depreciation	$	3,840	8,642	17,300	27,838	56,640
PTO aerators	number	6	7	8	12	45
Unit cost	$	1,500	2,065	2,065	2,262	2,262
Total cost	$	9,000	14,455	16,520	27,144	101,790
Useful life	year	10	10	10	10	10
Annual depreciation	$	900	1,446	1,652	2,714	10,179
Feeder	number	1	1	1	2	5
Unit cost	$	5,500	4,400	5,000	5,000	5,267
Total cost	$	5,500	4,400	5,000	10,000	26,335
Useful life	year	5	5	5	5	5
Annual depreciation	$	1,100	880	1,000	2,000	5,267
Feed bin	number	1	2	3	4	5
Unit cost	$	5,000	5,000	5,500	6,000	6,800
Total cost	$	5,000	10,000	16,500	24,000	34,000
Useful life	year	8	8	8	8	8
Annual depreciation	$	625	1,250	2,062	3,000	4,250
Pump	number	1	1	1	1	2
Unit cost	$	1,600	1,600	1,600	1,600	1,600
Total cost	$	1,600	1,600	1,600	1,600	3,200
Useful life	year	10	10	10	10	10
Annual depreciation	$	160	160	160	160	320

Appendix Table 1. Equipment list, from survey data (cont.)

Item	Unit	<100 acres	100-200 acres	200-300 acres	300-800 acres	>800 acres
Office shop, tools						
Unit cost	$	5,000	10,000	15,000	20,000	25,000
Total cost	$	5,000	10,000	15,000	20,000	25,000
Useful life	year	5	5	5	5	5
Annual depreciation	$	1,000	2,000	3,000	4,000	5,000
Utility trailer	number	-	1	1	2	3
Unit cost	$	-	800	800	800	1,700
Total cost	$	-	800	800	1,600	5,100
Useful life	year	-	10	10	10	10
Annual depreciation	$	-	80	80	160	510
Storage container	number	-	1	1	4	7
Unit cost	$	-	1,000	1,000	-	-
Total cost	$	-	1,000	1,000	-	-
Useful life	year	-	10	10	-	-
Annual depreciation	$	-	100	100	-	-
DO meter	number	-	1	1	4	7
Unit cost	$	-	500	500	750	1,350
Total cost	$	-	500	500	3,000	9,450
Useful life	year	-	5	5	5	5
Annual depreciation	$	-	100	100	600	1,890
Computer	number	-	1	1	1	1
Unit cost	$	-	1,650	1,650	2,000	2,000
Useful life	year	-	5	5	5	5
Annual depreciation	$	-	330	330	400	400
Generator	number	-	1	2	6	7
Unit cost	$	-	15,500	30,000	13,200	13,000
Total cost	$	-	15,500	60,000	79,200	91,000
Useful life	year	-	15	15	15	15
Annual depreciation	$	-	1,033	4,000	5,280	6,067
Shed	number	-	-	-	2	2
Unit cost	$	-	-	-	20,000	20,000
Total cost	$	-	-	-	40,000	40,000
Useful life	year	-	-	-	30	30
Annual depreciation	$	-	-	-	1,333	1,333
Electric panel boxes	number	-	-	-	36	72
Unit cost	$	-	-	-	50	50
Total cost	$	-	-	-	1,800	3,600
Useful life	year	-	-	-	10	10
Annual depreciation	$	-	-	-	180	360
Fish loader	number	-	-	-	1	1
Unit cost	$	-	-	-	3,000	3,000
Total cost	$	-	-	-	3,000	3,000
Useful life	year	-	-	-	10	10
Annual depreciation	$		-	-	300	300

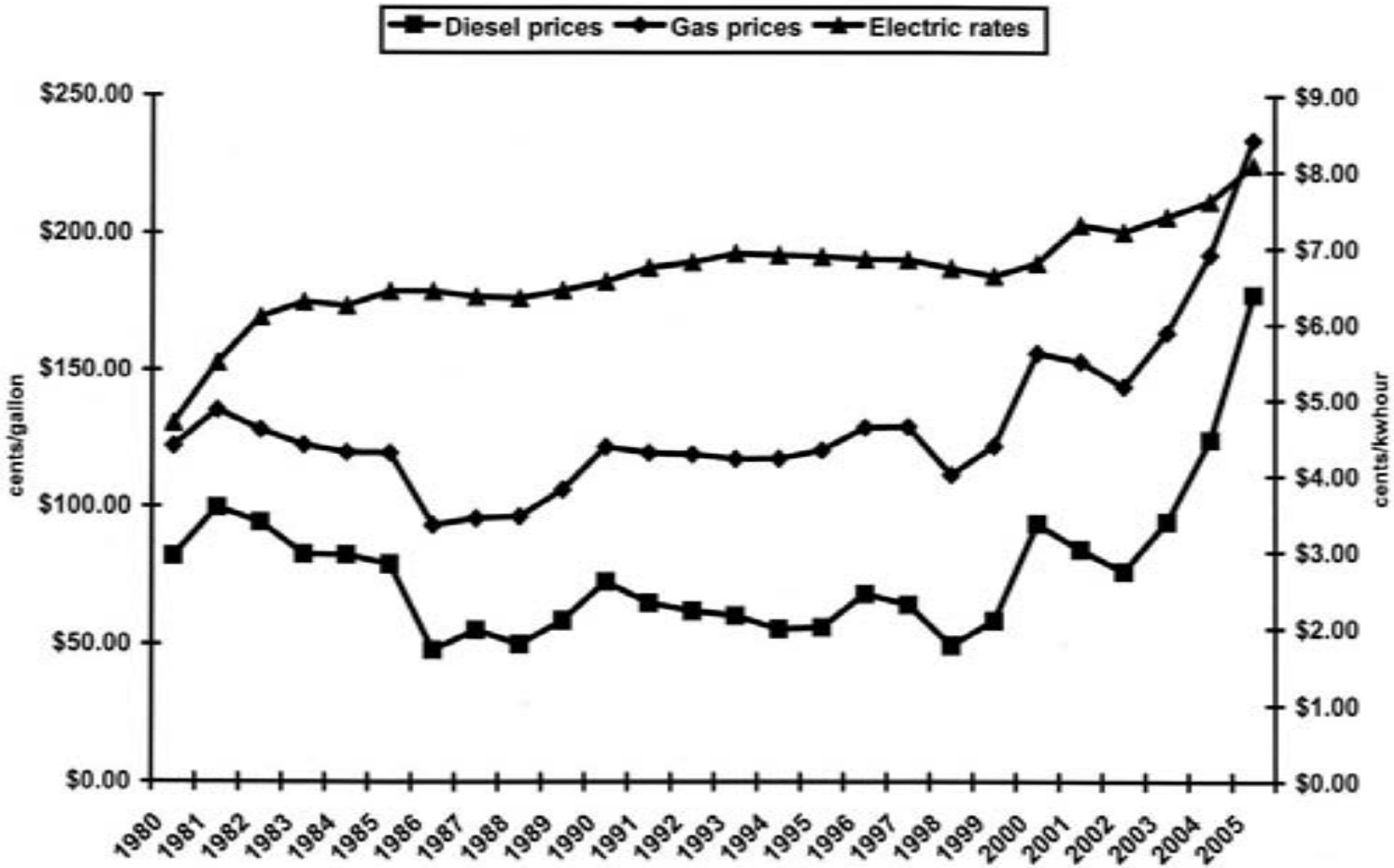
Appendix Table 1. Equipment list, from survey data (cont.)

Item	Unit	<100 acres	100-200 acres	200-300 acres	300-800 acres	> 800 acres
Digital scales	number	-	-	-	1	1
Unit cost	$	-	-	-	1,000	1,000
Total cost	$	-	-	-	1,000	1,000
Useful life	year	-	-	-	5	5
Annual depreciation	$	-	-	-	200	200
House trailer	number	-	-	-	1	1
Unit cost	$	-	-	-	22,000	22,000
Total cost	$	-	-	-	22,000	22,000
Useful life	year	-	-	-	15	15
Annual depreciation	$	-	-	-	1,467	1,467
Storage building	number	-	-	-	1	1
Unit cost	$	-	-	-	1,500	1,500
Total cost	$	-	-	-	1,500	1,500
Useful life	year	-	-	-	10	10
Annual depreciation	$	-	-	-	150	150
Radio	number	-	-	-	-	2
Unit cost	$	-	-	-	-	500
Total cost	$	-	-	-	-	1,000
Useful life	year	-	-	-	-	5
Annual depreciation	$	-	-	-	-	200
Rifle w/scope	number	-	-	-	-	1
Unit cost	$	-	-	-	-	607
Total cost	$	-	-	-	-	607
Useful life	year	-	-	-	-	5
Annual depreciation	$	-	-	-	-	121
Backhoe	number	-	-	-	-	1
Unit cost	$	-	-	-	-	22,088
Total cost	$	-	-	-	-	22,088
Useful life	year	-	-	-	-	15
Annual depreciation	$	-	-	-	-	1,473
Total Equipment Cost	**$**	**$138,100**	**$262,117**	**$387,570**	**$606,035**	**$1,471,171**
Annual Depreciation	**$**	**$14,110**	**$27,271**	**$42,707**	**$69,407**	**$152,818**

Appendix Table 2. Net returns/acre with yield sensitivities from 1,000 lb/acre/year to 7,000 lb/acre/year

Yield (lb/acre)	60-acre farm	131-acre farm	256-acre farm	431-acre farm	1,007-acre farm
Net returns to risk					
1,000	-2,421	-2,350	-2,199	-2,173	-2,149
1,500	-2,098	-2,027	-1,877	-1,850	-1,826
2,000	-1,775	-1,704	-1,554	-1,527	-1,504
2,500	-1,452	-1,381	-1,231	-1,204	-1,181
3,000	-1,129	-1,058	-908	-881	-858
3,500	-806	-735	-585	-558	-535
4,000	-483	-412	-262	-235	-212
4,500	-161	-89	61	88	111
5,000	162	234	384	411	434
5,500	485	557	707	733	757
6,000	808	880	1,030	1,056	1,080
6,500	1,131	1,203	1,353	1,379	1,403
7,000	1,454	1,525	1,676	1,702	1,726
Net returns to operator's labor, management and risk					
1,000	-2,211	-2,174	-2,116	-2,103	-2,115
1,500	-1,888	-1,851	-1,793	-1,780	-1,792
2,000	-1,566	-1,528	-1,470	-1,457	-1,469
2,500	-1,243	-1,205	-1,148	-1,134	-1,146
3,000	-920	-882	-825	-812	-823
3,500	-597	-559	-502	-489	-500
4,000	-274	-236	-179	-166	-177
4,500	49	87	144	157	146
5,000	372	409	467	480	469
5,500	695	732	790	803	792
6,000	1,018	1,055	1,113	1,126	1,115
6,500	1,341	1,378	1,436	1,449	1,437
7,000	1,664	1,701	1,759	1,772	1,760
Net returns above cash costs					
1,000	-1,710	-1,793	-1,640	-1,631	-1,603
1,500	-1,387	-1,470	-1,318	-1,308	-1,280
2,000	-1,064	-1,147	-995	-985	-957
2,500	-742	-824	-672	-662	-634
3,000	-419	-501	-349	-339	-311
3,500	-96	-178	-26	-16	12
4,000	227	145	297	307	335
4,500	550	468	620	630	658
5,000	873	791	943	953	981
5,500	1,196	1,114	1,266	1,276	1,304
6,000	1,519	1,437	1,589	1,598	1,627
6,500	1,842	1,759	1,912	1,921	1,950
7,000	2,165	2,082	2,235	2,244	2,272

Appendix Figure 1. Energy prices over time.



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