ECONOMICS AND RISKS OF INTENSIVE CATFISH PRODUCTION TECHNOLOGIES

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Rising costs of inputs and increased competition from imports have resulted in considerable contraction of the U.S. catfish industry over the last decade. The future success of catfish farming therefore depends on improvements in production practices that bring cost efficiencies. Such improvements can be achieved either by modifying existing traditional catfish production technologies or by technological innovation that results in greater productivity. A research study in the Mississippi Agricultural and Forestry Experiment Station simulated yield-increasing technologies such as intensively aerated ponds and split-pond systems. These intensive systems combine biological, chemical, and physical intensification elements into a single, integrated system providing better production control than traditional open-ponds.

Successful industry-wide adoption of these intensive systems will depend upon their productivity and cost efficiencies. With this objective in mind, economic analyses were conducted to determine costs, investment feasibility, and economic risks associated with these two intensive systems. Performance of the following three split-pond design scenarios were monitored in Arkansas and Mississippi: (1) a research design developed at the Thad Cochran National Warmwater Aquaculture Center, Stoneville, Mississippi; (2) a waterwheel design tested on commercial catfish ponds; and (3) a screw-pump design tested on commercial catfish ponds (Figure 1). An economic-engineering approach using standard enterprise budget analysis was used to develop estimates of breakeven prices (BEPs; $/lb) for producing food-size hybrid catfish (♂*Ictalurus furcatus* ×♀*Ictalurus punctatus*) for each scenario.

Estimates of BEPs of hybrid catfish raised in split ponds ranged from $0.78 to $0.93 per pound. The cost of catfish production in split ponds was sensitive to yield, fish prices, and feed prices. Annual net cash flows from both commercial split-pond systems were high and sufficient to make the investment profitable in the long run (Table 1). The most important contributors to risk when using split ponds were feed price, feed conversion ratio, and yield.

Similarly, economic monitoring was performed on commercial catfish farms that employ high levels of aeration (> 5 horsepower per acre) in Alabama, Arkansas, and Mississippi (Figure 2). A multivariate-cluster analysis was used to identify four different management clusters of intensively aerated commercial catfish farms based on stocking density, size of fingerlings at stocking, and feed conversion ratios (FCR). Aeration rates did not differ among the four management clus-

"IMPROVED PRODUCTIVITY FROM SPLIT PONDS AND INTENSIVELY AERATED PONDS HAS THE POTENTIAL TO REDUCE COSTS, INCREASE PRODUCTION, AND ENHANCE THE COMPETITIVENESS OF THE U.S. CATFISH INDUSTRY. THE ECONOMIC FEASIBILITY OF THESE INTENSIVE SYSTEMS DEPENDS HIGHLY ON FEEDING EFFICIENCY AND, AS SUCH, FEED MANAGEMENT IS EVEN MORE IMPORTANT IN THESE SYSTEMS THAN IN TRADITIONAL OPEN PONDS."

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Figure 1. *Screw-pump design developed by commercial catfish farmers.*

Figure 2. *Intensively areiated catfish ponds.*

ters (average = 7.7 horsepower per acre).

Breakeven prices of hybrid catfish raised in intensively aerated pond systems were estimated to range from $0.85/lb to $0.99 per pound, with the lowest costs associated with the second greatest level of production intensity. The two intermediate intensity clusters generated sufficiently high revenues for long-term profitability (Table 2). However, the least-intensive and the most-intensive clusters were economically feasible only when catfish and feed prices were closer

Table 1. *Production and economic performance of different split-pond designs.*

Parameters	Units	Research Design	Waterwheel Design	Screw-pump Design
Additional investment required for conversion	($/acre)	$7,750	$5,400	$4,000
Stocking density	(nos./acre)	12,800	12,000	14,000
Gross yield	(lbs/acre)	18,100	15,500	18,700
FCR	(ratio)	1.80	2.30	2.60
BEP/TC	($/lb)	$0.78	$0.93	$0.91
BEY/TC*	(lbs/acre)	14,207	14,143	16,834
Payback Period*	(yrs)	2.5	4.7	3.4
Net present value*	($/acre)	$16,274	$2,755	$6,135
Modified internal rate of returns*	(%)	21%	14%	17%
Probability of success (long-run economic conditions*)	(%)	100%	81%	88%
*@ fish price of $1.00/lb and feed price of $410/ton.				

to less probable market prices. Feed price, FCR, and yield contributed the most to downside risk. Intensive aeration in catfish ponds, up to the levels analyzed in this study, appears to be economically feasible under the medium-intensity management strategies identified in this analysis.

Given recent average prices of catfish ($1.00 per pound, or more) and the opportunity cost of capital (10%), split-pond production appears to have long-term economic feasibility. Producers could improve productivity of traditional ponds by the addition of aerators. However, adopters of intensive aeration practices should select appropriate stocking strategies that match the targeted pond production level. Strategic decisions on stocking densities, aeration rates, and flow rates (in split ponds) should be determined based on the intended final biomass of marketable-sized fish. Balancing key inputs (fingerlings and feed) with the level of capital investment and targeted yields is fundamental to the success of farms seeking to intensify production.

Owing to the high upfront investment and operating costs, these intensive systems should be adopted only after careful examination of equity and cash flow situations on individual farms. Feeding efficiency has always been a key to economic success in catfish farming, but is even more when raising fish in intensive production systems. The improved productivity that has been demonstrated in split-ponds and intensively aerated ponds under commercial conditions has potential to reduce costs, increase production, and enhance the competitiveness of the U.S. catfish industry.

Table 2. *Production and economic performance of different intensively aerated commercial pond management strategies.*

Parameters	Units	Low Intensive	Medium Intensive	High Intensive	Very-high Intensive
Additional investment for intensification	($/acre)	$2,994	$2,994	$2,994	$2,994
Stocking density	(nos./acre)	6,900	8,500	10,000	13,300
Gross yield	(lbs/acre)	11,500	13,000	14,600	15,500
FCR	(ratio)	2.50	2.24	2.06	2.61
BEP/TC	($/lb)	$0.99	$0.91	$0.85	$0.98
BEY/TC*	(lbs/acre)	11,362	11,862	12,416	15,155
Payback Period*	(yrs)	11.2	5.2	3.5	9.7
Net present value*	($/acre)	-$2,116	$863	$2,973	-$1,706
Modified internal rate of returns*	(%)	4%	12%	16%	5%
Probability of success (long-run economic conditions*)	(%)	91%	98%	100%	91%
*@ fish price of $1.00/lb and feed price of $410/ton.					