AGRICULTURAL ECONOMICS

Journal of Student Papers

PAPERS

ABSTRACTS

AMERICAN AGRICULTURAL ECONOMICS ASSOCIATION

Volume 6, No. 1
October 1988

AN ECONOMIC ANALYSIS OF ALTERNATIVE SOFTSHELL CRAWFISH PRODUCTION FACILITIES

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Abstract

Efforts to diversify Louisiana agriculture have increased interest in alternative enterprises such as aquaculture. As specialization within aquaculture has increased, interest has grown in the commercial viability of softshell crawfish production. This paper presents an economic evaluation of two assumed 40-tray softshell crawfish culture systems. Both flow-through and recirculating options are applied to the hypothetical facility and the resulting investment and operatinag costs are given. Estimated income statements are shown to be favorable for both systems. The recirculating system proves to be more efficient with regard to operating costs, with an approximate 14 percent increase in efficiency over the flow-through system. The recirculating system for this analysis achieves a break-even price of $4.20/pound at standard production capacity, while the average wholesale price for softshell crawfish is currently $8.00/pound.

INTRODUCTION

Due to the recent drop in prices for agricultural and petroleum commodities, it has become necessary for Louisiana to explore and utilize its alternative natural resources. A recent interest in aquaculture has led to further specialization in the area of crawfish farming, and in particular, softshell crawfish culture. The number of entrants in the new business of softshell crawfish production has risen from seven to an estimated two hundred in less than four years. (Roberts).

Given the potential success of this industry, many individuals are investing in softshell crawfish production. One of the most frequently asked questions in this context is, "How much does it cost to get started?" Answers to this question are limited due to the lack of information on basic production costs and costs of investing in aquaculture enterprises (Dellenbarger). In addition, alternative cultural practices are feasible for softshell crawfish production, flow through and recirculating systems. It has been long thought that the difference in operating costs for these two types of system varied greatly.

The author gratefully acknowledges the assistance of E. Jane Luzar and Lonnie R. Vandeveer, Department of Agricultural Economics and Agribusiness, and Dudley D. Culley, School of Forestry, Wildlife, and Fisheries, Louisiana State University.

OBJECTIVES

The objectives of this paper are to present an economic analysis of softshell crawfish production and to evaluate the two different technologies currently used in this production process. This paper first gives a brief overview of the production process for softshell crawfish culture. The economic differences between flow-through and recirculating methods are then examined based on a standard forty tray (1,000 pound) facility.

METHODS

The procedure used in this paper involves a financial analysis of the softshell crawfish production process using two technical production alternatives, flow-through and recirculating systems. Estimated investment requirements and depreciation charges are reported for both systems, along with the projected annual income for the two options. An economic evaluation of the two alternative systems is then presented. The paper concludes with some considerations for investment in softshell crawfish production.

SYSTEM DESIGN AND PRODUCTION PROCESS

The facility used to house the softshell crawfish system is a green house type structure which measures 18' x 56' (Culley, Said and Culley; Malone and Burden). Softshell crawfish facilities are usually referred to by the number of trays that a particular system employs. The standard tray size of a 3' x 8' x 6" is normally used. However, because some systems use different tray sizes, a more adequate indicator of a facility's size is a pounds of production value. The system used in this paper employs the use of 44 standard size trays, although only 40 of these are assumed to be in production. Four trays in the system are set up for molting purposes only. Therefore, 40 trays are used in the calculation of total system poundage. Crawfish production for this facility is estimated at 960 pounds in this analysis.

Crawfish are purchased in a hard, immature state and brought into the facility where they are slowly acclimated into the culture trays. Densities of one pound per square foot of tray were assumed to be optimal (Malone and Burden). Each day during the production season, a worker feeds the crawfish at one percent (1 percent) of their body weight/day. While feeding, premolt and dead crawfish are culled out of the existing stock. Each week, additional crawfish are acclimated into the facility to maintain the proper density. Crawfish which are darker than usual in color are indicative of crawfish approaching the molt. These are then put into a molting tray (one molting tray for every ten premolt trays).

During the next 24-36 hours, these crawfish will lose their exoskeleton and be removed by a worker. No processing of the animal is done except freezing. Any altering of the body before shipping would require a seafood processor's license. Crawfish are frozen in one pound quantities inside one quart airlock bags. These bags are frozen in a residential type freezer for sale at some future date. One full-time worker can operate up to 60 trays. However, this would require about six hours of labor per day, seven days a week per season. Thus, part-time help is assumed in the analysis.

The phrase "flow-through" denotes the one-way passage of water through a softshell crawfish system. In a flow-through system, water is pumped into a facility from some exterior source (i.e., ponds, well, city water, etc.) that is capable of producing the proper rate of flow per minute for a specific system. The water is then heated to a desired temperature of about 80 F.

Recirculating systems employ a loop design in which system water is not discarded, yet it is recycled to avoid heat loss. In a recirculating system, water from an external source (i.e., well ponds, city water, etc.) is collected in an amount that will provide a proper flow rate for a specific system (normally 5-10 gallons of water per pound of crawfish). The water is then heated to a desired temperature of 80 F, sprayed on trays, drained, treated, and recycled. The recycling of a system's water is done through a series of filters. These filters are a combination of fluidized beds and upflow sand filters. Filters of this type are used primarily to clean the waste of excess ammonia and waste debris. The upflow filters are flushed periodically and water losses are replaced into the system by the primary water source. The end result of a recirculating system that is properly designed is the successful breakdown of ammonia and waste, and the maintainance of a minimal heat loss of 1-2 F.

The primary economic difference of flow-through and recirculating systems is that of energy costs. The operating costs of the two systems can vary greatly, primarily to the amount of water heating required by each system.

In order to evaluate a 40 tray flow-through system, several assumptions must first be set forth. The assumptions used here are based on a hypothetical facility defined by specialists in the Department of Fisheries at LSU and are currently representative of an average size within the industry. The criteria used for this facility attempts to identify an investor's financial requirements for investing in a 40 tray softshell crawfish production system. It is in no way reflective of all 40 tray operations and is subject to input variation.

Other assumptions are that the proposed 40 tray flow-through facility would operate seven months out of the year (December - June). The operational procedure that arrives at total annual costs assumes that in the the first month, December, the facility would be in a start-up phase. After the first month crawfish would be marketed each week. It is further assumed that demand will be sufficient to sell all of the produce at a market price of $8.00/lb. (current wholesale price).

Due to the assumption of no production in December, 100 percent capacity will be assumed for the six months of January through June. During these months, the maximum production will be based on total poundage in production (960 pounds) multiplied by a conservative daily molting rate (.025). Also included will be a 1 percent daily mortality rate for incoming crawfish.

The facility will be constructed on the owner/operator's land and therefore, investments for land were not included. The owner/operator will provide 90 percent of the required labor at $5.00/hour for 4 hours per day. Part-time help will be needed only for 10 hours a week at approximately $4.00/hour during the months of January through June. Labor costs for management were estimated in a manner to reflect the alternative costs of hiring. The assumed land will have no access to a major water source and thus a well will be drilled for use in the system. This system employs 44 trays. However, only 40 of these are used in actual production calculations, as 4 are needed for molting purposes.

Supply crawfish used in stocking and replacement were estimated at $1.00/lb. These crawfish were stocked at a density of one pound per square foot. Densities above this amount increase labor and reduce the molting rate (Culley, Said, and Culley; Huner and Barr).

The proposed facility will be of a greenhouse type structure and will be contract built for two months before the beginning of the first year's season. To facilitate this construction, a commercial loan will be obtained in September. Thus, the fiscal year will also begin at this time. The commercial loan would be secured by using the owner/operator's land as collateral. The loan was amortized for four years at a 12 percent commercial interest rate (Barry, Hopkin and Banker). Terms of the loan included no payments until January, when the first income is accrued for the business. An operating loan is assumed for financing operating inputs, or revolving line of credit would also be established. This would allow for a short term borrowing on operating capital items such as inventory and wages. The rate would be 1.5 percent per month and short term loans would generally last no more than three months.

INVESTMENT COSTS

Estimates in Table 1 provide a detailed breakdown of costs and associated depreciation for all inputs used in the assumed 40 tray flow-through and recycling system. All input estimates have been calculated to include labor plus materials. Input price data were derived by use of telephone interviews with several contractors and suppliers. Most estimates were obtained by calculating a mean of the 3-5 estimates obtained for each input. Depreciation was calculated for each input by using a straight-line method and assuming no salvage value.

Total investment costs for the flow-through system is estimated at $13,254 while the investment cost of the recirculating system is estimated at $15,066. Differences in investment costs are primarily due to differences in sources of water and investment in recycling equipment. In addition, a boiler is required in the flow-through system whereas commercial water recycling equipment is required for the recirculating system.

ESTIMATED INCOME

Time for each of the systems was estimated assuming a six month production period and a $8.00 price for softshell crawfish. The estimates also include a one percent mortality rate. Table 2 presents projected annual income statement of the 40 tray flow-through and recirculating softshell crawfish facilities. The projected income statement reflects the potential profitability of the systems. Income generated in this statement is represented by net returns. Net return estimates in Table 2 represent a return to land and management. Operating cost estimates shown in Table 2 indicate that labor, monthly replacement of crawfish, and energy requirements are the major expenses for the flow-through system while major expenses for the recirculating system include labor and replacement of craw-

Table 1. Estimated Investment Requirements and Depreciation Charges for Softshell Crawfish Production Systems, Louisiana, 1988.

Item	Flow-Through System		Recirculating System	
	Investment	Depreciation	Investment	Depreciation
Greenhouse	$ 4,990.00	$ 490.00	$ 4,990.00	$ 490.00
Limestone Slab	345.00	17.50	345.00	17.50
Water Well	2,665.00	266.50	1,700.00	170.00
Plumbing	318.00	31.80	--	--
Commercial Water Recycling Component System	--	--	3,485.00	348.50
Sump and Reservoir	--	--	350.00	17.50
Wiring	100.00	5.00	100.00	5.00
Gas line	150.00	7.50	150.00	7.50
Trays (44)	1,660.00	415.00	1,660.00	415.00
Stands	572.00	190.66	572.00	190.66
Refrigerator	600.00	85.71	600.00	85.71
Double Sink	55.00	3.60	55.00	3.60
Desks, Tables, Chairs	50.00	10.00	50.00	10.00
Water Heating (250,000 BTU Boiler)	1,130.00	56.00	--	--
Water Heating (Hot (Water Heater)	--	--	300.00	30.00
Miscellaneous	619.00	--	709.000	--
TOTAL	$13,254.00	$1,600.00	$15,066.00	$1,792.00

fish. Cost estimates indicate substantial cost savings associated with water heating for the recirculating system when compared to the flow through system.

Net returns for the flow-through system are estimated at $11,338 while net returns for the recirculating system are estimataed at $16,407. Fixed costs for the recirculating system are slightly higher than for the flow-through system, however these higher fixed costs for the recirculating system are more than offset by savings in operating cost requirements. Energy requirements for heating water for the recirculating system are estimated at $300 while these same costs for the flow-through system are estimated at $5,075.

COMPARATIVE ANALYSIS

Investment requirements along with costs and returns for the two systems are summarized in Table 3. In addition break even prices were computed from cost estimates and estimated production levels. The estimated break-even price for the flow-through system indicates that a producer would need to receive $5.38 per pound for softshell crawfish to cover specified costs of production.

In general, the estimates of this analysis suggest that soft shell crawfish production is a profitable investment. For both systems, expected annual net returns were estimated to be substantial, especially when compared to the initial investment. This suggests a relatively favorable payback period for both investments. However, it is noted that all costs including land, repair and mainatenance charges are not included in the analysis.

Comparison of the two systems suggest that the recirculating system is the more profitable investment. Expected annual net returns for the

Table 2. Estimated Annual Income for Alternative Softshell Crawfish Productions Systems, Louisiana, 1988.

Item	Flow Through System	Recirculating System
INCOME		
Sales	$34,560	$34,560
Total cash income	34,560	34,560
EXPENSES		
OPERATING		
labor:		
owner/operator	4,200	4,200
part-time	1,008	1,008
crawfish:		
initial stocking	1,000	1,000
monthly replacement	6,048	6,048
transportation	510	510
electricity	1,065	500
water heating[a]	5,075	300
feed	330	330
miscellaneous	700	700
Total operating expenses	19,936	14,596
FIXED		
interest	1,686	1,765
depreciation	1,600	1,792
Total fixed expenses	3,286	3,557
TOTAL EXPENSES	23,222	18,153
NET RETURNS	11,338	16,407

[a]Natural gas is used to heat water

recirculating system are estimataed at $16,407 while these net returns for the flow-through system are estimated at $11,338. The recirculating system might also be more desirable if the investor is sensitive to price variations in softshell crawfish. For example, if softshell crawfish

Table 3. Economic Evaluation of Alternative Softshell Crawfish Production Systems, Louisiana, 1988

Item	Flow Through System	Recirculating System
Initial Investment	$13,254.00	$15,066.00
Sales	34,560.00	34,560.00
Total Annual Costs	23,222.00	18,153.00
Break-Even Prices at Standard Capacity 6 Month Season	5.38	4.20
Expected Annual Net Returns	11,338.00	16,407.00

prices fell to $5.00 per pound, the produce would not be covering all costs of production with the flow-through system while all costs would be covered with recirculating system.

SUMMARY AND CONCLUSIONS

Aquaculture has become a profitable new industry in Louisiana. As it develops further, specialization and efficiency will occur. The soft-shelled crawfish industry shows encouraging glimpses of this diversification. This paper has provided basic production and investment requirements. The establishment of an 18' x 56' soft-shelled crawfish culturing facility will permit the use of 40, 3 x 8 culture trays, double-stacked and 4 molting trays. This system can be either a flow-through or recirculating type. This paper incorporated both systems into an assumed 40 tray model. The economic analysis suggests that both systems are feasible when employed in the 40 tray facility design. Initial investments from $13,254 to $15,066 were sufficient in establishing these systems.

The recirculating options, however, proved to be the more efficient. Although its initial investment was higher, its annual operating costs were approximately $5,340 less than that of the flow-through system. In addition, the recirculating system proved to be more stable with a standard capacity, 6 month break-even price of $4.20. This is $1.20 less than that of the flow through system's and approximately $3.80 below the established the wholesale market price of $8.00.

Projected net returns for both systems gave a favorable indication of the potential profits that each system could generate. Once again, the recirculating option proved to be more efficient with a $5,114 increase in estimated returns to management over that of the flow-through system.

The previous analysis indicates that both options (flow-through and recirculating) are profitable for the hypothetical facility assumed in this paper. The recirculating option, however, due to this increase in efficiency as to operating costs, proved to be the most profitable. The slight increase in initial investment for a recirculating softshell crawfish culture system is warranted when compared to the same size facility using a flow-through design.

All investment estimates are subject to change, depending upon the potential investor and his financial situation. Moreover, these results did not include land costs and other costs such as repair, maintenance and other overhead costs of operation.

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