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Crawfish Production

Production Economics, Pond Construction and Water Supply

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The species of crawfish (or crayfish) commercially important in the southeast United States are the red swamp crawfish (*Procambarus clarkii*) and the white river crawfish (*Procambarus zonangulus*). Culture methods used to grow crawfish are relatively simple as compared to those for other cultured aquatic animals. Formulated feeds are not used routinely. Instead, vegetation is established as the food base (e.g., rice, sorghum-sudangrass or natural aquatic plants). Rather than stocking crawfish ponds with hatchery-reared young, farmers stock with brookstock or rely on reproduction by unharvested crawfish from the previous year.

Crawfish culture can fit well with farm management plans because it uses marginal agricultural lands, existing labor, and farm equipment during off-peak farming periods. The integration of rice farming and crawfish culture has worked extremely well in the southeast U.S. Disadvantages of crawfish culture are the high volume of water required, the lengthy and expensive harvesting period, and unstable markets.

The profitability of crawfish farming varies from year to year and with the type of crawfish production system. That is because yields, costs, break-even prices, and market prices are highly variable and often unpredictable. A prospective producer should discuss the feasibility of a project or business plan with an Extension agent, who can provide the best available data at the time of the request.

A look at production economics, pond construction, and water supply can help potential producers decide whether or not crawfish production would be a viable enterprise. The economic data presented here are based on Louisiana production figures.

Production economics

Investment requirements

An economic analysis of crawfish production should be based on sound production cost estimates and realistic income projections. Crawfish are cultured in a variety of ways, but most commonly in cultivated forage ponds or in double-crop rotation systems with rice or soybeans. For details on these production practices see SRAC publications 241 and 242. Cultivated forage ponds are constructed and managed solely for crawfish production; planted forages supply the detrital food on which crawfish feed. In rice-crawfish double cropping rice stubble supplies the detrital food chain and the harvest of rice provides a second income source each year.

Table 1 itemizes projected costs for cultivated forage ponds and rice-crawfish double crops. These costs are based primarily on a 1990 survey of 39 commercial crawfish producers, with supplemental information from researchers and Extension personnel. The survey collected information on production, harvesting, and marketing practices. Costs have been adjusted to reflect 1998 values. Cost estimates are presented on a "per acre" basis so they can be applied to different size operations. Fixed costs were based on a 120-acre production unit consisting of six 20-acre ponds. The average annual interest rate on the investment in the pond, well, and specialized equipment was assumed to be 6.4 percent. Although projected costs for the rice-crawfish double crop are considerably more than for the cultivated forage pond, an additional income of $405 per acre can be realized from the rice crop.

Table 2 shows break-even selling prices required to recover costs for four alternative yield levels. To evaluate the feasibility of beginning a crawfish operation if you are not already farming, use

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Table 1. Projected costs per acre for two crawfish production systems: cultivated forage ponds and rice-crawfish double cropping.							
		Cultivated forage pond			Rice-crawfish double crop		
Item	Unit	Price ($)	Quantity (# of units)	Amount ($)	Price ($)	Quantity (# of units)	Amount ($)
Direct expenses							
Custom applications[1]	cwt[2]	4.24	2.15	9.12	0.98	96.99	94.87
Bait	lbs.	0.18	470.00	86.65	0.19	263.00	49.69
Fertilizer	lbs.	0.12	75.00	9.00	0.22	222.00	48.03
Herbicides	qts.	–	–	–	4.76	6.00	28.56
Hired labor	hours	7.50	1.85	13.88	7.50	2.89	21.68
Other	misc.	–	–	12.15	–	–	38.45
Seed	lbs.	0.19	140.00	25.90	0.19	140.00	25.90
Operator labor	hours	7.50	8.58	64.37	7.50	8.31	62.32
Owner labor	hours	–	–	–	12.00	0.42	5.02
Irrigation labor	hours	7.50	0.17	1.24	7.50	0.30	2.25
Diesel fuel	gals.	0.85	40.33	34.56	0.85	82.64	70.24
Gasoline	gals.	1.20	3.12	3.75	1.20	4.23	5.07
Repairs and maintenance	acres	27.76	1.00	27.76	50.98	1.00	50.98
Interest on operating capital	acres	15.45	1.00	15.45	35.21	1.00	35.21
Total Direct Expenses				303.62			538.26
Fixed Expenses							
Implements[3]	acres	1.95	1.00	1.95	6.35	1.00	6.35
Tractors	acres	2.52	1.00	2.52	13.85	1.00	13.85
Harvesting boat	acres	6.85	1.00	6.85	33.29	1.00	33.29
Irrigation	acres	31.44	1.00	31.44	31.44	1.00	31.44
Ponds and equipment	acres	89.55	1.00	89.55	36.53	1.00	36.53
Total Fixed Expenses				132.32			121.46
Total Specified Expenses				435.94			659.72
Allocated Cost Items							
General farm overhead	acres	64.48	1	64.48	64.48	1	64.48
Land (opportunity cost)	acres	45.00	1	45.00	45.00	1	45.00

[1]Contracted applications of rice seed, fertilizer and herbicides, and drying and storage of harvested rice.

[2]1 cwt = per 100 pounds of rice.

[3]Implements such as disks, mowers and planters.

the "Prices required to cover total specified costs and general farm overhead." Established farmers considering diversifying into crawfish should use the "Prices required to cover total specified costs." "Prices required to cover direct expenses" should be used to construct a cash flow statement or to estimate out-of-pocket expenses.

Table 2 shows that farmers who are producing rice are in the best position to start crawfish production. Many of the costs associated with producing crawfish have already been covered by the rice operation.

Any aquaculture venture should be approached cautiously. A business plan should be devel-

Table 2. Break-even selling prices for crawfish for selected yield levels.[1]					
	Total	Yield level (lbs./acre)			
	costs	600	800	1,000	1,200
	$/acre	Break-even cost ($/lb.)			
Prices required to cover total specified costs and general farm overhead					
Cultivated forage pond	500	0.83	0.63	0.50	0.42
Rice-crawfish double crop[2]	319	0.53	0.40	0.32	0.27
Prices required to cover total specified costs					
Cultivated forage pond	436	0.73	0.55	0.44	0.36
Rice-crawfish double crop[2]	254	0.42	0.32	0.25	0.21
Prices required to cover direct expenses					
Cultivated forage pond	304	0.51	0.38	0.30	0.25
Rice-crawfish double crop[2]	211	0.35	0.26	0.21	0.18

[1]Expenses DO NOT include family living, debt service or land changes.

[2]Break-even selling prices for crawfish double cropped with rice represent the net cost of producing crawfish in the double-crop situation compared to producing rice alone.

oped that includes production, economic and marketing data. (For details on developing loan proposals see SRAC publication 381). Remember that the cost estimates presented in this publication are based on data collected in Louisiana on relatively large farms (120 acres in 6- to 20-acre ponds). This data, while valuable for estimating average production costs, may show some economies of scale and should be used cautiously by small or very large crawfish production facilities.

Pond construction

Pond location and design are the most important physical factors for successful crawfish production. Existing rice fields often are used, but the most productive and easiest to manage ponds are those constructed specifically for producing crawfish. Proper pond construction gives the crawfish farmer better control over flooding, drainage, forage and water management, and harvesting. Although some management practices can be changed easily to improve production, modifying or renovating ponds that were improperly constructed can be expensive. Before construction, seek advice from your county Extension agent and the Natural Resources Conservation Service engineer in your area.

Location

Crawfish ponds should be located in flat, open areas where soils have sufficient amounts of clay. Clay loams, sandy clay loams, and silty clay loams are satisfactory soil types. Clay soil holds water and maintains the integrity of crawfish burrows. Crawfish will die in sandy soil where burrows collapse or dry out easily.

Pond design

Perimeter levees should have a core trench cleared of debris to prevent water seepage. The bases of perimeter levees should be at least 9 feet wide to prevent leakage caused by burrowing crawfish. A levee system 3 feet high will contain the 12 to 18 inches of water necessary to cultivate crawfish. The land should have no more than a 6-inch fall between perimeter levees. Otherwise, the area should be leveled or divided into two or more ponds. A pond with a steep elevation difference complicates forage and water management and impairs harvesting efficiency. Typical ponds are 10 to 20 acres, and most producers manage 100 or fewer acres.

Ponds should be designed to drain thoroughly. Standing water hinders tillage operations and forage establishment. Ditches should be positioned outside the perimeter levees. Interior ditches reduce circulation throughout the pond, causing areas away from the channel to have low dissolved oxygen during critical times. This reduces the effective production area of the pond. Also, interior ditches may harbor predatory fish after ponds are drained.

Interior or baffle levees guide water through the pond, properly distributing aerated water and helping maintain good water quality (Fig. 1). Baffle levees are built about 6 feet wide at the base and do not require a core trench. They should extend at least 6 inches above the expected water level for the pond. If the part of the baffle levee above the water line is not substantial enough, settling and erosion will cause the levee to breach in a year or two. Baffle levees should be spaced 150 to 300 feet apart for best water circulation.

Recirculating pond water is important where the surface water quality or quantity fluctuates or where well water must be pumped from great depths at higher cost (Fig. 2). A return canal outside the perimeter levee and a re-lift pump or paddlewheel aerator will help recirculate water and minimize effluent.

Drains should be appropriate for the pond size, pumping capacity and projected rainfall. Two 10-inch drains are sufficient for a 20-acre pond. Pond levees should allow vehicle access in all weather conditions for efficient use of harvesting equipment.

Water supply

Both surface and subsurface water can be acceptable for crawfish farming. Well water is free of predators but has a limited discharge capacity and higher pumping cost. Surface water is less costly to pump, but may not be reliable in quantity or quality. Surface

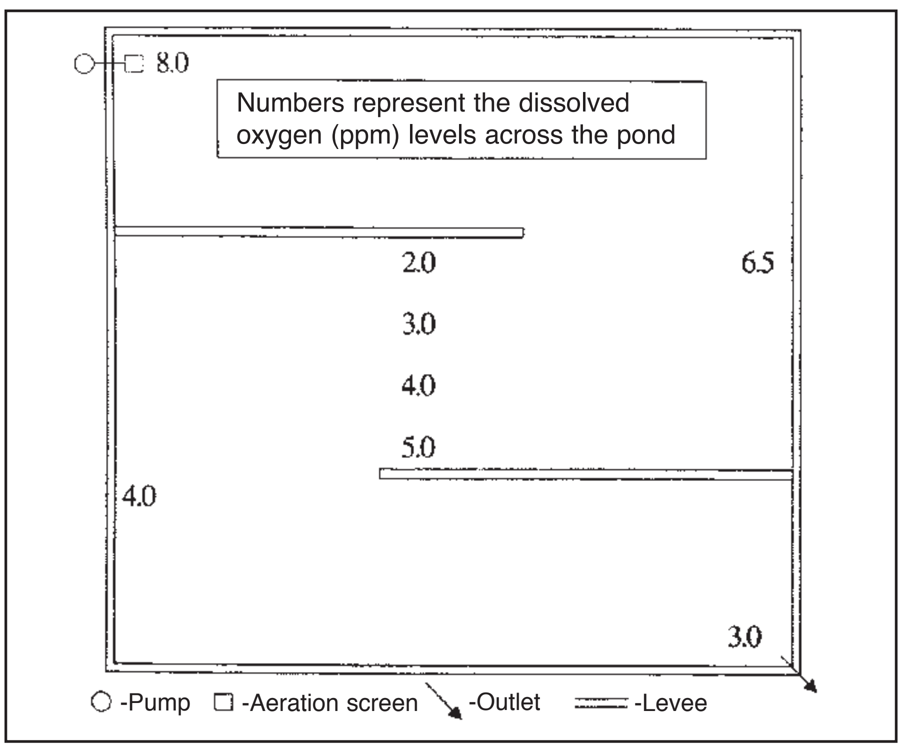

Figure 1. Construction plan for a crawfish pond showing a perimeter levee and baffle levees.

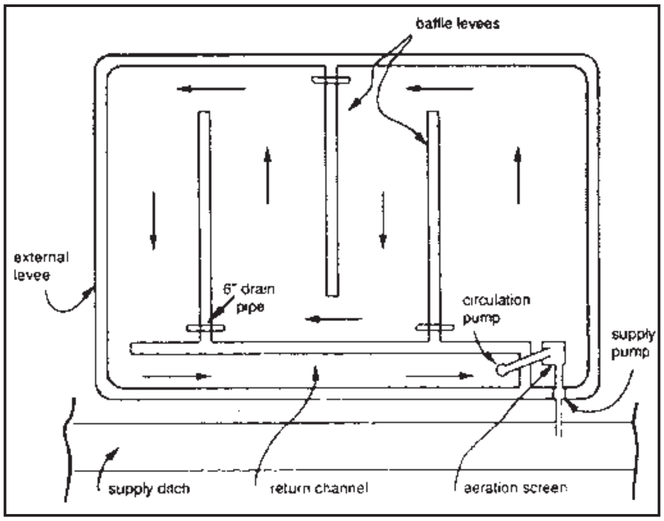

Figure 2. Construction plan for a crawfish pond showing a perimeter levee and baffle levees with recirculation capabilities.

water also can contain predatory fishes that must be removed. Passing surface water through small mesh screens can effectively remove most fish and aerate the water (Fig. 3). Small fish not retained by screens may compete with the crawfish for food items and prey upon small crawfish. Pools or puddles remaining when the pond is drained in summer should be treated with a fish toxicant.

Figure 3. Aeration screens used on pump discharges.

Pumps, motors and pipes must be matched to the system and to each other to obtain the most efficient performance. Lift should be minimized as much as possible to reduce pumping costs.

Water quality

The quality of water required to produce crawfish is similar to that required by most warm-water aquatic animals. Important water quality variables are dissolved oxygen, pH, total hardness, total alkalinity, ammonia, nitrite, iron, hydrogen sulfide, and salinity.

Dissolved oxygen is the most important factor in water quality. It should be maintained above 3 parts per million (ppm) for optimal crawfish production. Oxygen deficiency is corrected by replacing pond water with fresh, oxygenated water or by recirculating water with pumps or mechanical aerators. Pumping water through an aeration screen divides the water into small droplets and aids in oxygen transfer. Well water can also be aerated by exposure to air as it travels through supply ditches.

Water pH should range from 6.5 to 8.5 at dawn; both total hardness and total alkalinity should range from 50 to 250 ppm as calcium carbonate (100 ppm is optimal). If the pH, hardness, and alkalinity are low, incorporate agricultural limestone into the pond during the next dry cycle to increase the levels of calcium carbonates.

Un-ionized ammonia and nitrite are toxic to crawfish at concentrations higher than 2 and 4 ppm (as nitrogen), respectively. Concentrations this high are unlikely in well water or crawfish ponds because crawfish production intensity is low and ammonia is rapidly taken up by phytoplankton and aquatic plants. Iron and hydrogen sulfide are toxic to crawfish at concentrations often found in well water, but the two compounds may be lowered to non-harmful concentrations when well water is oxygenated. Where iron and hydrogen sulfide concentrations are high, it may be necessary to place a supply ditch or pond between the well and the crawfish pond. This will allow the iron to precipitate and hydrogen sulfide to dissipate.

Crawfish farmers in coastal regions should monitor tidal influence on surface waters. Crawfish tolerance to salinity is directly proportional to crawfish size. Newly hatched young may die at 8 parts per thousand (ppt), while adult crawfish can tolerate salinities up to 35 ppt (sea water) for a short time. Salinity affects vegetation at much lower concentrations. Crawfish ponds should not be located where salinities higher than 5 to10 ppt are likely to occur.

Water quantity

The quantity of available water often limits crawfish culture. Intensive production requires a pumping capacity of 70 to 100 gallons per minute per surface acre. This rate is needed to exchange all the water in the pond over a 4- to 5-day period, especially in the early fall when the pond is flooded onto decomposing vegetation. Adding 4 to 6 inches of water at flood-up rather than the full, harvesting depth of 12 to 18 inches will reduce the amount of water needed for oxygen management. The depth would then be gradually increased as water temperature cools.

A pond with dense vegetation may need seven to nine water exchanges per season to maintain good water quality. If poor quality water is discharged, total water usage for the season can be as high as 10 to 16 acre-feet of water per surface acre of pond. Recirculation systems can reduce water usage to less than 3 acre-feet per surface acre of pond.

Conclusion

Crawfish aquaculture has proven profitable throughout much of the Southeast. This publication has attempted to describe the basics of pond construction, water supply, and water quality and quantity needed to produce crawfish, along with the basic costs of production. For further information on crawfish production see SRAC publications 241 and 242.

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