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Effect of Production and Credit Management Factors on Catfish Investment and Profitability

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EFFECT OF PRODUCTION AND CREDIT MANAGEMENT FACTORS ON CATFISH INVESTMENT AND PROFITABILITY

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INTRODUCTION

RAISING CHANNEL CATFISH is a relatively new farm enterprise in the United States. Current production is concentrated in Mississippi, Alabama, and Arkansas, respectively the largest producing states *(7)*. Catfish production has been the fastest growing major farm enterprise in Alabama during the last 5 years. At present there are about 10,000 acres of catfish ponds in production in the State, and farmers continue to express strong interest in beginning or expanding production.

The decision to produce catfish presents several problems not previously encountered by most farmers. For example, raising catfish usually requires construction of ponds to impound water. This capital investment frequently exceeds the value of the land on which ponds are built *(8)*. Because of the expense and difficulty involved in removing dams, levees, and draining structures once they have been established, pond construction permanently alters the nature of land use. This aspect of catfish production irreversibly commits the farm firm to a long-term investment project.

A related feature of catfish production is the pronounced efficiencies or economies of size associated with pond construction *(8)*. Per acre earth moving requirements often de-

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crease substantially as the size of the pond increases. Operating economies that accompany increasing size are also common *(1, 3, 8)*. With the exception of a few large firms that raise seedstock and grow and market the fish, catfish production represents diversification of existing farm firms. The transition to include the catfish enterprise in the organization of an existing farm (along with row crop and livestock enterprises) is not well understood. While large ponds benefit from size economies associated with pond construction and operation, land is taken out of production for up to 1½ years before a cash return from sale of fish is realized. The income foregone from this land during the initial fish crop production period, combined with the relatively large capital outlay for pond construction, can be substantial obstacles to entry into commercial catfish production.

Technology for catfish farming has developed rapidly *(5)*. Nutritionally "complete" diets are now available from commercial sources. Techniques for managing water quality have been developed as well as methods and drugs for disease treatment. Intensification of catfish production has followed the adoption of improved technology, making possible higher stocking and feeding rates. Production intensification leads to greater returns to the pond resource *(3)*, but it is also associated with increased risk of losing the fish crop, primarily because of the increased frequency of drastically depressed dissolved oxygen levels *(2)*.

Unique production constraints, increased risks of large operations, and rapidly advancing technologies have resulted in serious gaps in producer knowledge of recommended management practices to maximize profits. This study explored the effects of several production management decisions on the profitability of the catfish enterprise. The focus upon financial factors is especially useful in view of the cash flow and credit difficulties that characterize many farms in today's environment of high interest rates and low commodity prices.

PURPOSE OF STUDY

In this study, key production and credit management factors that favor the transition of a typical western Alabama farm to include a commercial catfish enterprise were analyzed. A broad definition of management was used that includes several factors. Production management was comprised of stock-

ing rate, pond size, conservation tax deduction on ponds, and a price or net income premium for a quality product, table 1.

Many farmers have been uncertain as to proper usage of the conservation tax deduction. The tax aspects of the pond construction investment decision are viewed to be a management factor in the same way as managing the quality of the product. Both increase after-tax profits. Product quality is a complex issue that relates to the ability of the producer to deliver the required size fish at the appropriate time. Product quality is also a result of a series of production management decisions related to post-stocking activities. These include feeding rates, water quality management, and disease prevention and treatment. Because of the difficulties of judging fish gain rates and size (when the fish cannot be seen), quality control is an even larger issue than with other farm livestock enterprises.

Credit management factors consist of alternative maximum debt-use levels and alternative beginning debt positions, table 1. These two factors have been shown to be of critical importance in numerous studies of other enterprises. This study's definition of production and credit management does not include several important factors such as alternative interest rate levels, default conditions, feed conversion rates, and death loss rates. Instead, this study focused on factors that become of critical importance after basic production skills have been acquired, and that can be readily influenced by the decisions of individual producers. For example, a producer cannot individually change market interest rates, but must

TABLE 1. PRODUCTION AND CREDIT MANAGEMENT FACTORS ANALYZED

Production management	Credit management
Catfish stocking rate	Maximum debt level
Low (2,500 fish/acre)	Zero (no debt permitted)
High (4,500 fish/acre)	Medium (debt limited to 30 percent of assets)
Individual pond size	High (debt limited to 70 percent of assets)
Small (5 acres)	
Medium (10 acres)	
Large (20 acres)	Initial debt position
	Zero (no beginning debt)
Pond conservation tax deduction	Medium (beginning debt is 35 percent of borrowing capacity)
Yes	High (beginning debt is 70 percent of borrowing capacity)
No	
Quality price (or income) premium	
None	
$0.10/lb. or 15 percent increase in gross revenues	

make the decision to borrow and at what level. It is recognized that beginning debt position is difficult to control unless the farmer has nonfarm investments or little-used farm assets that can be sold, or he can reduce investment in other less profitable enterprises.

The first step in the study was the development of a representative farm. The number of acres and other resources of the farm were based on an average farm in the western Black Belt of Alabama, as described in the U.S. Census of Agriculture. Counties in this area include Dallas, Greene, Hale, Marengo, Perry, Sumter, and Tuscaloosa, figure 1. Currently, the majority of commercial catfish production occurs in these counties.

Two large processing plants were located at Greensboro in Hale County at the time of the study, and the topography and soils in the area favor pond construction. Nearly 900 acres of ponds were constructed for catfish production in the study area during 1981, and requests for technical assistance for construction of an additional 1,400 acres are pending with the Soil Conservation Service district offices.[2]

Enterprises for the representative farm include a 30-cow beef brood herd, cotton, soybeans, and catfish. The farm was not permitted to raise fewer than 30 beef cows, reflecting the desire of many farmers to produce beef because of personal preference. Based on census data, row-crop land was only 124 of the total 440 acres in the farm. Thus, most of the farm was in pasture, hay, and woodlands. The farm's machinery complement was assumed to be on a 10-year, straight-line depreciation schedule. Hired labor was available, but it was assumed that every 10 hours of hired labor required 1 hour of management by the farm operator. Additional land was assumed to be unavailable for renting or purchase, thus the farm was permitted to grow only through more intensive use of owned resources. Also, $12,000 was allocated annually for family living expense.

Optimal enterprise levels for the representative farm were determined with a technique that allocates resources to the most profitable outputs. This method assured that enterprises which generate the highest level of net income were included in the farm organization. Cost, price, and yield data prepared by the Alabama Cooperative Extension Service were utilized

[2]Personal communication, Kelley, D., State Biologist, Soil Conservation Service, Auburn, Alabama.

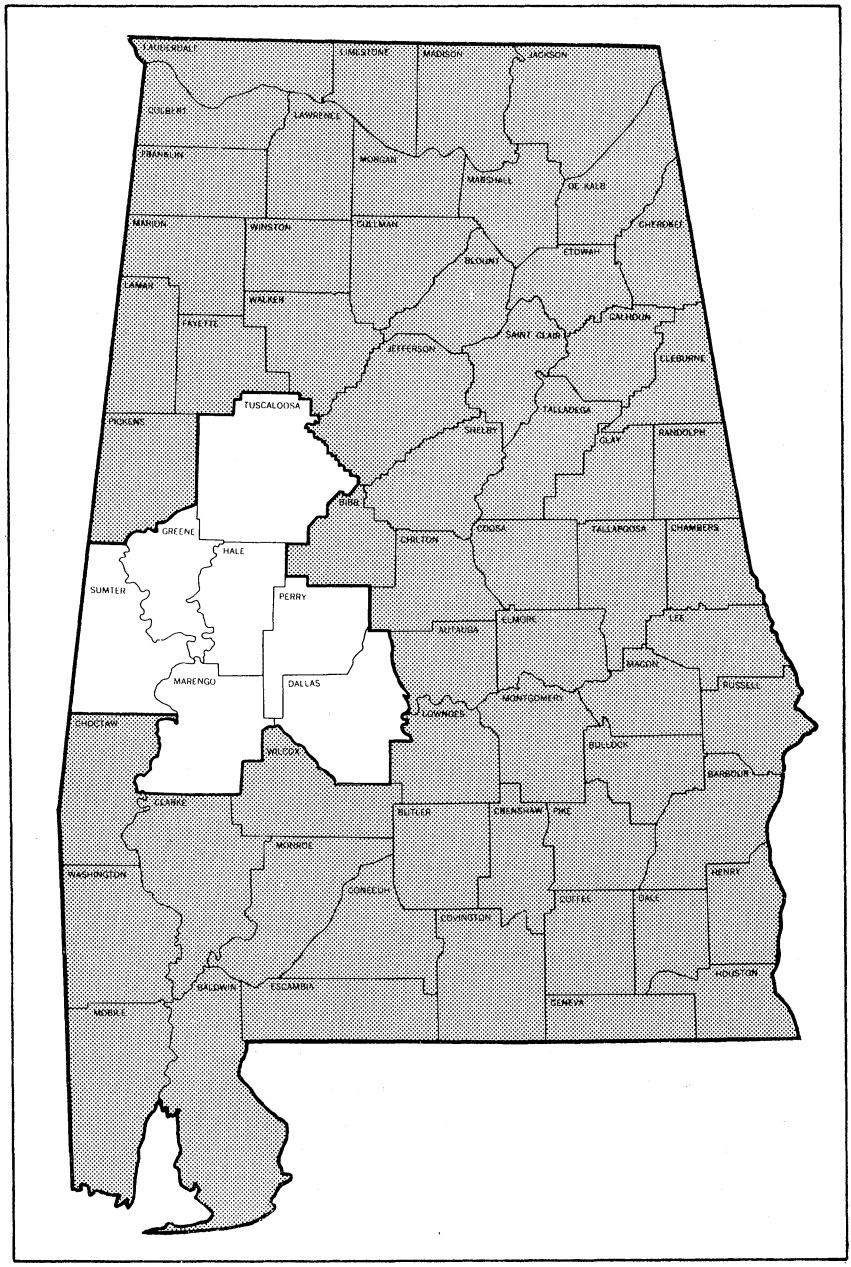

FIG. 1. Seven-county study area located in the Black Belt Region of west-central Alabama.

to estimate expected production levels and resultant net farm income. (A budget for 20-acre ponds is provided in the Appendix.) The income maximizing technique used these data to solve for optimal organization for the representative farm in each of the 10 years in the planning horizon or study period. The indivisible nature of large, bulky assets, such as tractors or ponds, that cannot be purchased in fractional amounts, was also incorporated in the model. Finally, while assumptions for the representative farm and the income optimization technique will not match any specific farm operation, these assumptions do enable farm lenders and farm investors to explore the feasibility of internal growth with a catfish enterprise.

RESULTS: PRODUCTION DECISIONS AND CATFISH PROFITS

Because farmers typically reinvest profits back into their farm operation, one of the most used measures of farm profitability is change in net worth, the increase or decrease of the farm family's equity in the farm. This study measures the success of a management decision by observing its impact on net worth over a 10-year study period.

Effect of Pond Size on Profit

Past studies have suggested that large size ponds are more efficient than small ponds, especially from an investment or cost perspective. However, as pond size increases, more capital is committed and consequently if credit is used, financial risk (the added risk from use of borrowed money) increases. In addition, the possibility of losing all of the fish in the pond because of disease or oxygen depletion increases the production risk of large ponds. Also, sites suitable for building large ponds may be limited on many farms, thereby limiting pond building alternatives. This situation was explored by restricting the model to only 10-acre pond building activities in one case and 5-acre pond activities in another. Assumptions also included the following: total debt was restricted to 30 percent of total assets, no initial farm debt existed, and the high catfish stocking rate of 4,500 fish per acre was maintained.

With only 10-acre pond sites available, optimal organization of the farm limited pond construction to four units (40 acres), of which three were constructed in the first year and the remaining pond built in the third year. This level compares to a

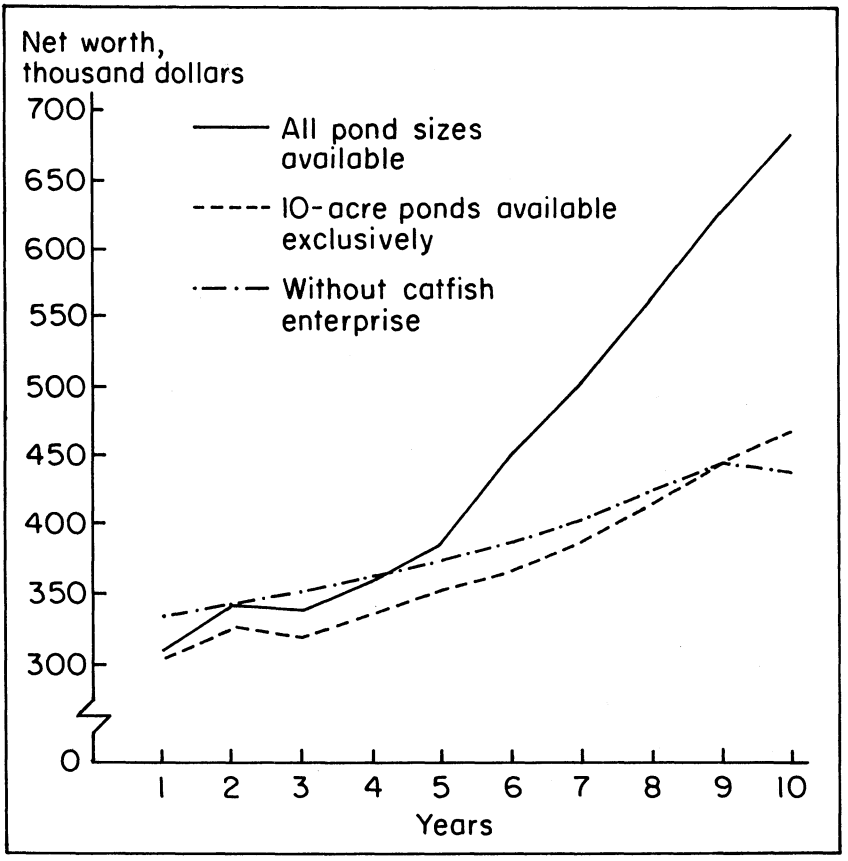

FIG. 2. Farm net worth over time with all pond size alternatives, 10-acre pond sites only available and without a catfish production enterprise. All situations with no initial debt, 30 percent debt limit, and high catfish stocking rate.

total of five 20-acre ponds constructed where 20-acre sites were an alternative. The result was that ending net worth was substantially less where only 10-acre sites were available. In fact, ending net worth increased only marginally with the 10-acre ponds as compared to the farm with no catfish enterprise, figure 2. The large difference in net worth at the end of year 10 points out the importance of the capital investment structure (i.e. types of investments made) to the success of a catfish enterprise.

When pond construction was restricted to 5-acre sites, no pond building occurred. Thus, the higher pond construction costs for small units, along with their higher per unit operating

TABLE 2. SUMMARY OF POND CONSTRUCTION, CHANGES IN NET WORTH AND ANNUALIZED RATE OF CHANGE IN NET WORTH FOR CASES ANALYZED[1]

	Acres ponds constructed	10-year increase in net worth	Annualized rate of[2] increase in net worth
		Dol.	*Pct.*
Pond sizes available			
20 acres or less	100	347,796	7.4
10 acres or less	40	131,334	3.4
5 acres	0	101,410	2.6
Catfish stocking rate			
4,500 fish/acre	100	347,796	7.4
2,500 fish/acre	80	137,950	3.5
Conservation tax deduction			
Taken	100	347,796	7.4
Not taken	60	285,721	6.3
Quality price or income premium			
Yes	100	347,796	7.4
15 percent decline in sales revenues	0	101,410	2.6
Borrowing level permitted			
High	110	388,095	7.9
Medium	100	347,796	7.4
Zero	40	135,948	3.5
Initial debt position			
None	100	347,796	7.4
Medium	80	205,322	5.4
High	20	11,288	.4

[1]Unless otherwise indicated, above results are based on optimal conditions which include high stocking rate, conservation tax deduction taken, all pond sizes available, $0.65 catfish price, zero initial debt, and medium debt level permitted. Results are for all farm enterprises combined. The farm growth rate without catfish was 2.6 percent, and net worth increased $101,410.

[2]While the increase in net worth is $100,000 or more (with the exception of the last case), the annualized rate of increase in net worth is a better measure of growth for farmers to compare with.

costs, make ponds of 5 acres or less a less attractive avenue for intensive growth on existing farms. Pond construction, increase in net worth, and annualized rate of increase in net worth are summarized in table 2 for alternative pond sizes.

Obtaining a Premium Price

The importance of proven management to limit production losses to a small margin and deliver a top quality product that receives top market prices was explored by assuming that good quality catfish commanded a price of $0.65 per pound. It was also assumed that a lower quality product (or alternatively reduced yields due to disease, brown blood losses, or other production problems) would result in a reduction of sales revenues by about 15 percent, but with no reduction in production costs.

The reduction in catfish revenues due to lower per unit price or decreased sales caused catfish production to be com-

pletely excluded from the farm organization. Use of debt did not change this result because the catfish enterprise was simply less profitable than cotton. The most profitable use of available surpluses from the beef cow herd and cotton was earning interest in a savings account (since additional land was not available for expansion).

This result lends itself to two important conclusions. First, that a 15 percent decline in revenues from catfish sales due to inability to obtain top prices or due to disease losses or other management problems basically eliminated catfish profitability. Interpreted in another way, there is little margin for future price declines given 1981 costs and prices. Second, good management that successfully assures timely marketing of a top quality product is essential for the profitability of the catfish enterprise.

The Effect of Stocking Rates on Profit

The high costs of pond construction suggest at the outset that profits will decline if fewer fish are marketed from each acre of catfish pond. In this respect, a low catfish management intensity can be equated to a stocking and production rate of 2,500 fish per acre. This rate is considered a relatively low-risk enterprise. Less experienced fish farmers, or those with limited management capabilities, may prefer this production system. Returns to the pond resource, however, have been estimated to be considerably less under the low management intensity system than under a high stocking rate of 4,500 fish per acre *(3)*. The comparison of the low stocking rate to the high rates used in the foregoing discussion of efficient pond sizes provides insight into alternatives that permit catfish to become an optimal part of a farm organization. Analysis of low versus high stocking rates also measures the effect of management intensity on firm growth.

With the low stocking rate and no debt, the process of building ponds and growing catfish continued to be an optimal part of the farm organization. However, the pond building pattern for the low stocking rate was quite different from the high stocking rate case, figure 3. With the low (2,500 fish per acre) rate, one 20-acre unit was constructed in period 1 and three 20-acre units were constructed at the beginning of period 5, completing the pond building. Although additional land was available for pond sites, returns from the catfish enterprise were insufficient to warrant building more than

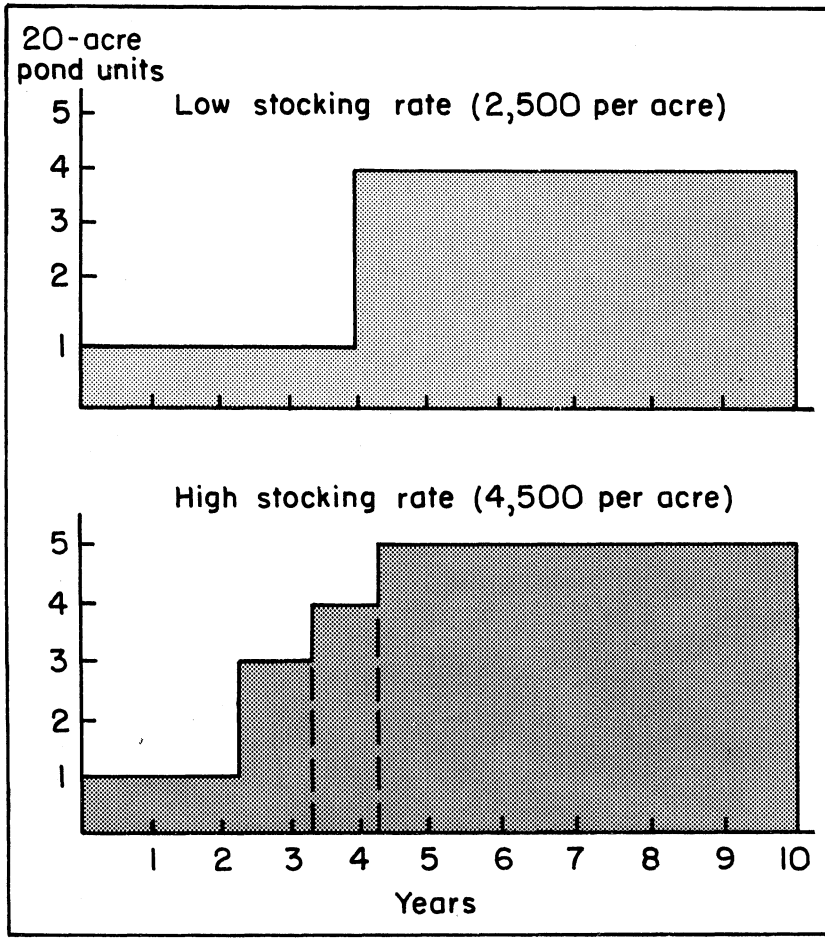

FIG. 3. Ponds built with low and high catfish stocking rates (zero initial debt, 30 percent debt limit).

four ponds. (The reason that three 20-acre units were constructed in period 5 was related to minimizing the tax burden. A large quantity of catfish was carried forward and sold in period 5 while the excess tax deduction from building the 60 acres of ponds in period 5 was carried forward to period 6. This shift partially offset income derived from the large catfish sale in period 6.) In contrast, a high stocking rate resulted in earlier construction of ponds, and a total of five 20-acre ponds, figure 3.

As illustrated in figure 4, terminal net worth was much less in the low intensity management systems because (1) debt

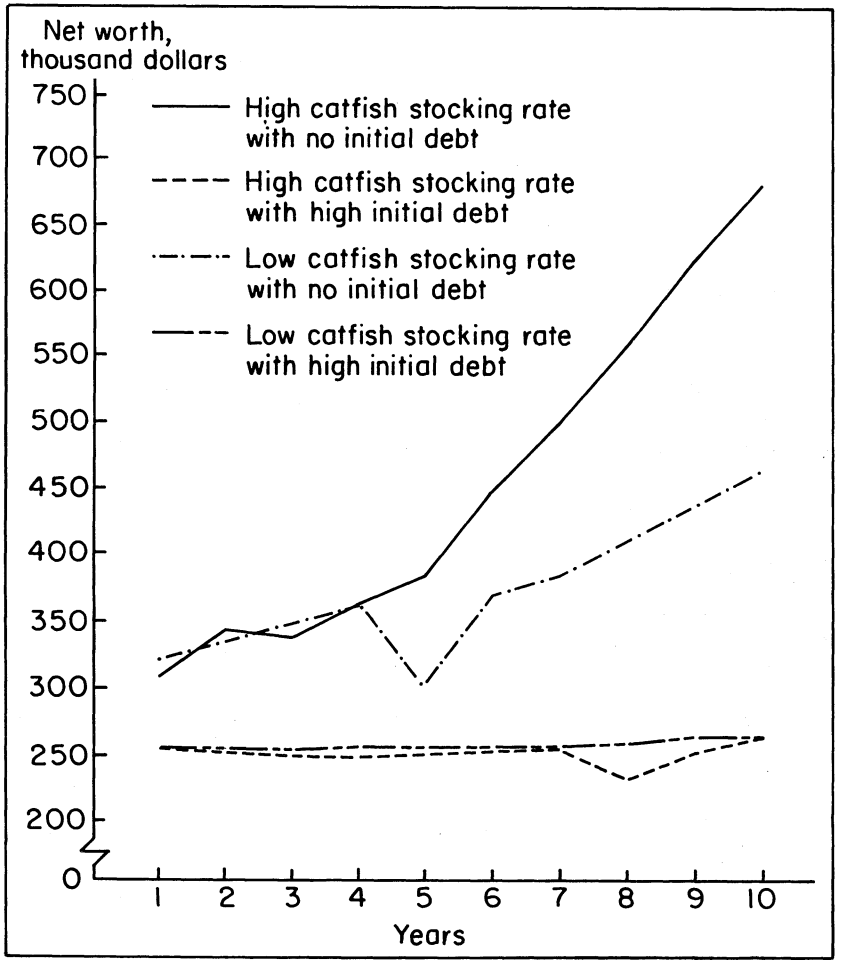

FIG. 4. Farm net worth over time with two catfish stocking rates and two initial debt situations.

from pond construction was repaid slower because of lower catfish sales and profits, and (2) because ponds were constructed later in the planning horizon, allowing less time for the surplus from catfish production to accumulate. Notice that compared to the initial farm organization, net worth was virtually unchanged by the introduction of catfish in the high initial debt situation, figure 4. The 14 percent interest rate applied in the study severely limited profitability, even when high stocking rates were utilized. This clearly illustrates the importance of debt management under current agricultural conditions.

The Effect of the Conservation Deduction on Profit

As farmers have increasingly recognized in the 1970's, farm management includes tax management. Farmers often find it is difficult to claim depreciation on ponds because the IRS usually requires the farmer to prove pond life is limited and that expected pond life can be readily estimated. However, hill pond construction expenses appear to qualify for the soil and water conservation deduction. According to the IRS, "the total deduction in any tax year of expenditures of a capital nature for soil and water conservation is limited to 25 percent of gross income from farming during the year" (1981 Farmer's Tax Guide, p. 42). Additionally, any unused deduction may be carried over to succeeding years if deductible soil and water conservation expenditures in any one year are more than 25 percent of gross income from farming in such year. However, the amount deducted in any succeeding year must not be more

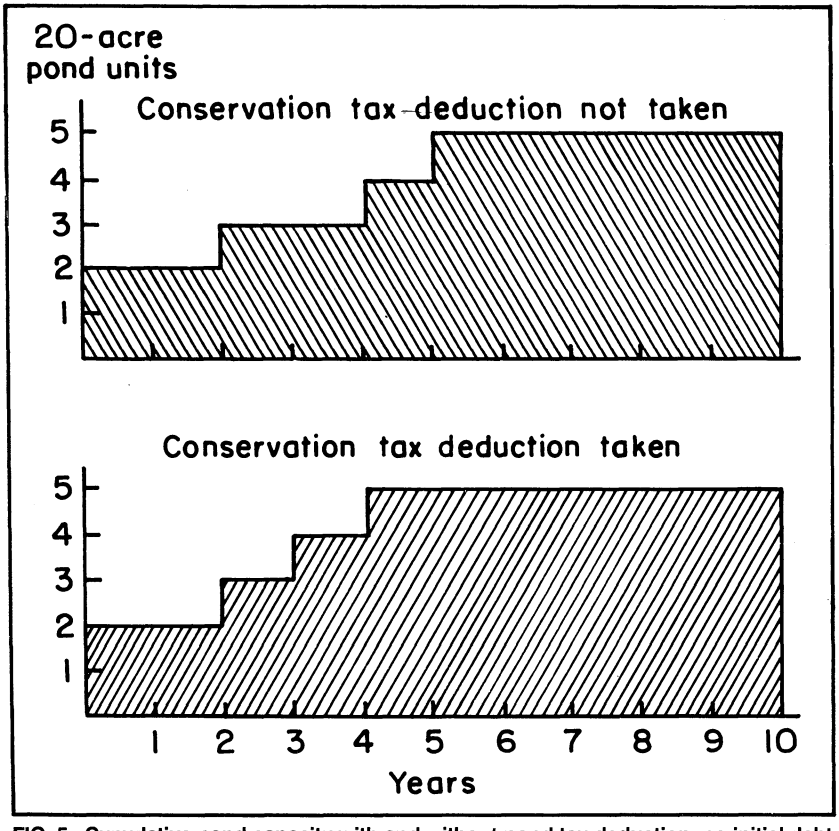

FIG. 5. Cumulative pond capacity with and without pond tax deduction, no initial debt.

than 25 percent of the gross income from farming during the year the deduction is taken. This feature of the tax code is of considerable interest to potential catfish farmers since it essentially allows pond construction costs to be treated as a cash deduction within the limits of the 25 percent gross income provision.

The impact of the federal income tax provision permitting deduction of pond construction costs was evaluated by excluding the deduction feature from the model. Pond building patterns were changed somewhat when the pond tax deduction was not taken, figure 5. At the beginning of the fourth year, three ponds had been built when the tax deduction was not

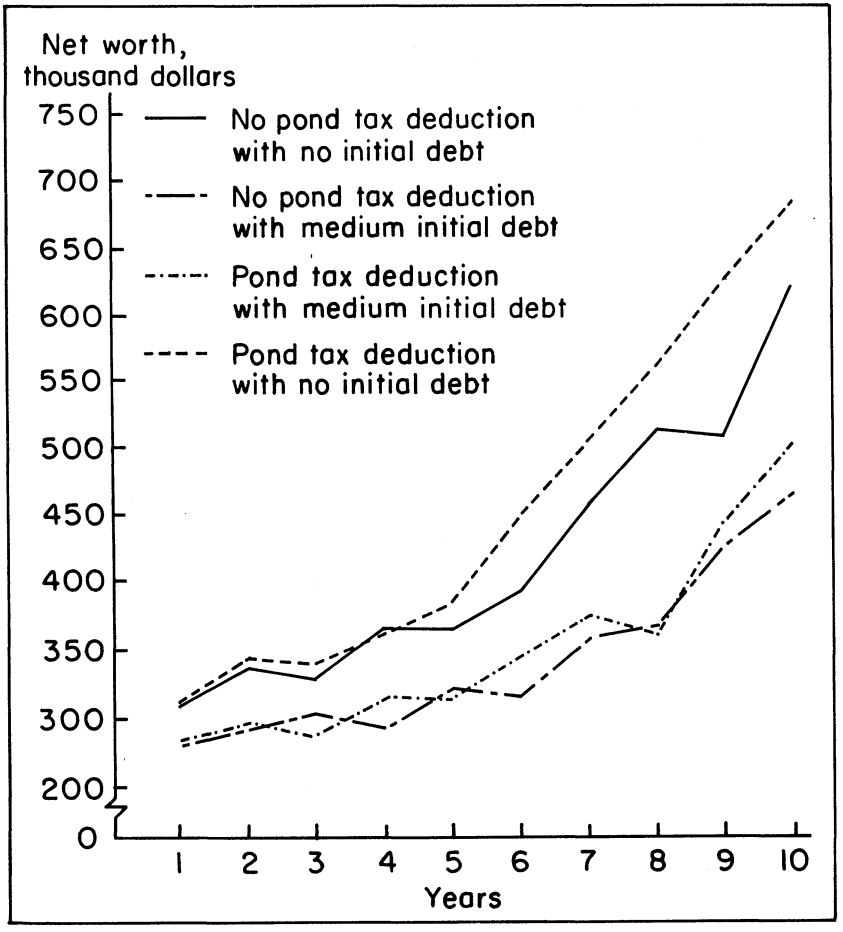

FIG. 6. Farm net worth over time with and without the pond tax deduction with two initial debt situations.

permitted, and four ponds had been constructed when the deduction was permitted.

Thus, the conservation tax deduction accelerated the rate of growth. The upper two lines of figure 6 compare net worth over time with and without the pond tax deduction, when no initial debt was outstanding. Cash withdrawals for additional income taxes (when the conservation deduction was not permitted) caused the pond building generally to be spread over a longer time and to occur later in the planning horizon. The combination of higher taxes and delayed catfish production caused terminal net worth to be about $62,000 less than when the pond tax deduction was allowed. This indicates that farmers should aggressively explore the feasibility of taking this deduction whenever possible.

CREDIT MANAGEMENT RESULTS

Assumptions described earlier to maximize farm profit were adopted to explore the effects of beginning debt and borrowing capacity on profitability. These "base case" assumptions are: high catfish stocking rates, the conservation tax deduction taken, availability of large ponds to lower per acre investment costs, and no reduction in sales revenues due to a low quality product, inefficient food conversion rates, or disease losses, table 3.

No Initial Debt

Servicing farm debt principal and interest payments has become a major problem for both beginning and well-established farmers. During 1981, payments of the interest on short-term debt increased more than any other major input cost category. Total interest payments (both short- and long-term) also exceeded net farm income for the first time in recent history.

The effect of low, medium, and high initial debt burdens (respectively, zero, $40,000, and $80,000) on the catfish enterprise can be most directly seen in pond building activity. This is shown in figure 7 for the medium debt limit case, where debt is limited to 30 percent of assets. As shown, two 20-acre ponds were built in the first period. More detailed descriptions of changes in the farm operation related to catfish expansion are provided in table 2. Cotton was produced on the rowcrop land remaining after pond construction, and the non-

TABLE 3. OPTIMUM FARM ORGANIZATION OVER TIME WITH THE HIGH CATFISH STOCKING RATE, 30 PERCENT DEBT LIMIT AND ZERO INITIAL DEBT

	Year									
	1	2	3	4	5	6	7	8	9	10
Net worth ($)[1]	310,438	342,740	340,400	361,306	387,610	449,727	501,672	560,423	623,069	683,851
Adjusted gross income ($)	5,400	22,200	17,822	24,210	32,282	22,200	31,900	13,900	5,400	5,400
Income tax ($)	0	3,273	2,228	3,836	6,242	3,273	6,201	1,404	0	0
Pond tax deduction ($)										
Current year	25,997	14,002	20,000	20,000	20,000	0	0	0	0	0
Carried forward	14,002	0	0	0	0	0	0	0	0	0
20-acre ponds	2	0	1	1	1	0	0	0	0	0
Catfish sold (lb.)	0	170,650	189,349	270,000	360,000	395,430	379,493	362,080	345,174	317,821
Catfish carry forward (lb.)[2]	0	9,349	0	0	0	54,569	125,076	212,995	317,821	450,000
Long-term debt ($)	60,852	121,242	110,955	123,521	132,521	127,029	101,876	81,135	67,355	0
Short-term debt ($)	12,888	25,032	23,712	28,464	32,625	39,288	39,288	39,288	39,288	127,038
Acres cotton	80	80	58	36	0	14	14	14	14	14
Cattle	250	250	250	250	250	250	250	250	250	250
Acres soybeans	0	0	0	0	9	0	0	0	0	0

[1]Net worth measured at year end.

[2]The model permitted up to one year's production to be carried forward. This markedly decreased tax liabilities since production expenses could be claimed when incurred, usually one tax year prior to the sales revenue associated with this expense. Cashflow, marketing, and production constraints may not permit sales to be delayed in a typical farm situation.

rowcrop land was forced to produce at least 30 cows throughout the planning horizon. Also, part of the rowcrop equipment was sold in period 1, with the proceeds used as operating cash.

No pond building occurred in period two because the debt limit was reached. Long-term debt in period two increased sharply because of three factors: (1) partial repayment of the loan for pond construction in period 2, (2) catfish equipment for 40 acres of ponds was purchased, and (3) the catfish enterprise required heavy operating cash withdrawal, part of which was financed by borrowing on long-term security and transferring the cash to operating capital.

Single 20-acre pond units were built at the beginning of each of periods 3 to 5. Capital rationing limited more rapid pond building. Capital limitations in period 5 were so severe that soybeans, having a lesser operating capital requirement, replaced cotton on the rowcrop land and some rowcrop land was left idle. After period 5, enough land for a 10-acre pond remained, but no further pond construction occurred. Instead, revenues from catfish sales were applied toward reducing debt. Net worth more than doubled in 10 years, from $310,438 to $683,851, table 3. Net worth increased steadily after the last pond was built in period 5, reflecting continuous catfish production and debt repayment generated from catfish sales. When no prior debt existed, catfish production contributed favorably to intensive firm growth, table 3. Even with capital constraints, building large ponds with accumulated savings (or increased borrowing capacity from debt repayment over a prolonged period) was favored over building smaller ponds.

Medium Initial Debt

In the medium initial debt situation, 35 percent of initial borrowing capacity had been utilized prior to considering the catfish enterprise as an addition to the farm. This level of beginning debt substantially altered the pond building pattern from the no initial debt case. Only four 20-acre pond units were built over the planning horizon: one each at the beginning of periods 1, 3, 5, and 6, figure 7. Capital rationing, as expected, was a constraint to further expansion of the catfish production enterprise. Also, the pace of pond construction was delayed until sufficient debt was repaid to provide borrowing capacity to finance the large 20-acre pond unit. Smaller pond units were not built even though they would have required a smaller capital outlay.

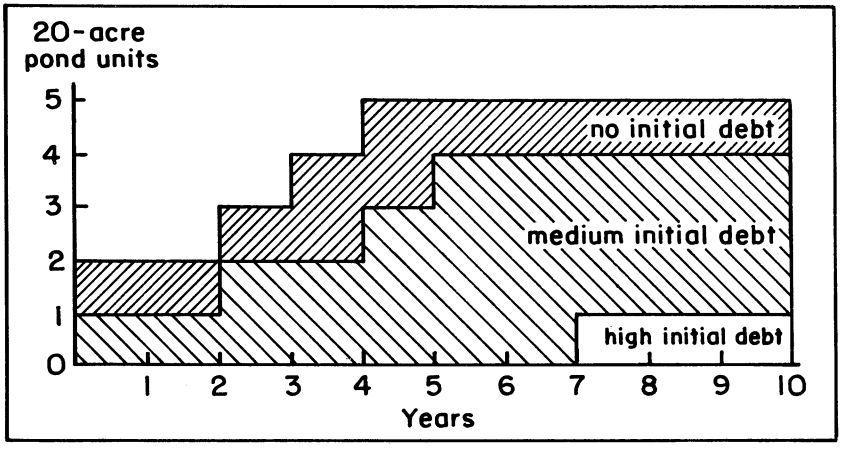

FIG. 7. Ponds built with 30 percent debt limit and three initial debt situations.

Cotton production was reduced as rowcrop land was taken for pond building and cash from rowcrop equipment sales returned to operating capital. Cattle were produced in the same quantity as before, and final net worth was about $180,000 less than with the zero debt situation, reflecting higher interest payments and opportunity costs of capital.

High Initial Debt

In this case, 70 percent ($80,000) of initial borrowing capacity had been used prior to considering catfish as an alternative enterprise. The effect of this large outstanding debt on the catfish enterprise was pronounced, limiting construction to one 20-acre pond at the beginning of period 8, figure 7. The high interest payments required to service past debt commitments severely restricted the availability of capital for investment in catfish. Net worth increased only about $14,000 over the 10-year study period. Also, less cash intensive soybean production was substituted for cotton since cash was utilized for catfish production equipment and fish stock.

The lesson is quite clear in the high initial debt case. Under conditions representing production costs and returns in 1981, investment in a catfish enterprise was not sufficiently profitable to substantially improve the financial well-being of the farm. If the high debt exposure of the farm was the result of past management difficulties, catfish production was not able to pay back previous indebtedness and increase profits.

No Borrowing Permitted

A farm situation without borrowing activities was analyzed to determine if building ponds and producing catfish could be internally financed from the existing soybean, cotton, and beef herd enterprises. Starting available cash reserves of $20,000 were assumed, a reasonable assumption for an ongoing farming operation with fully owned capital assets. When use of borrowed funds was not permitted, sufficient retained earnings from the farm were accumulated to build one 20-acre pond at the beginning of period 5, and an additional 20-acre pond at the beginning of period 7, figure 8A.

Note that even without financial leverage, the alternative of building smaller ponds requiring a lesser capital outlay was not adopted. Instead, larger and more expensive pond units were built, which required waiting for relatively larger savings accumulations. This outcome was not expected, but it serves to underscore the impact of capital rationing, both internally and externally, on the transition to catfish production. It indicates that returns to limited capital and land are greater for cotton than for catfish production in smaller pond units. Also, net worth increased at a low relatively constant rate from about $343,000 to $472,000 during the 10-year period.

Medium Borrowing Capacity

The effects of medium borrowing capacity with alternative initial debt positions were shown at the beginning of the discussion of credit management factors, figure 7. Medium borrowing capacity (and zero initial debt) resulted in a much more rapid rate of pond construction than when no borrowing was permitted, figure 8B. A total of 100 acres of ponds was built by the beginning of period 5. This rapid rate of pond construction demonstrates the usefulness of moderate financial leverage under current catfish production conditions.

High Borrowing Capacity

The effect of high borrowing capacity (which allowed debt to reach 70 percent of farm assets) on net worth accumulation and pond building activity was very marked. Again, a zero initial debt level was assumed so the full effect of raising debt limits could be seen. As illustrated in figure 8C, five 20-acre units were built at the beginning of period 1 and one 10-acre unit was built at the beginning of period 3. Pond building in

these two periods occupied all suitable land. Heavy borrowing occurred in the early periods to finance pond construction with the surpluses from catfish production successively applied to reduce debt. Long-term debt was nearly eliminated

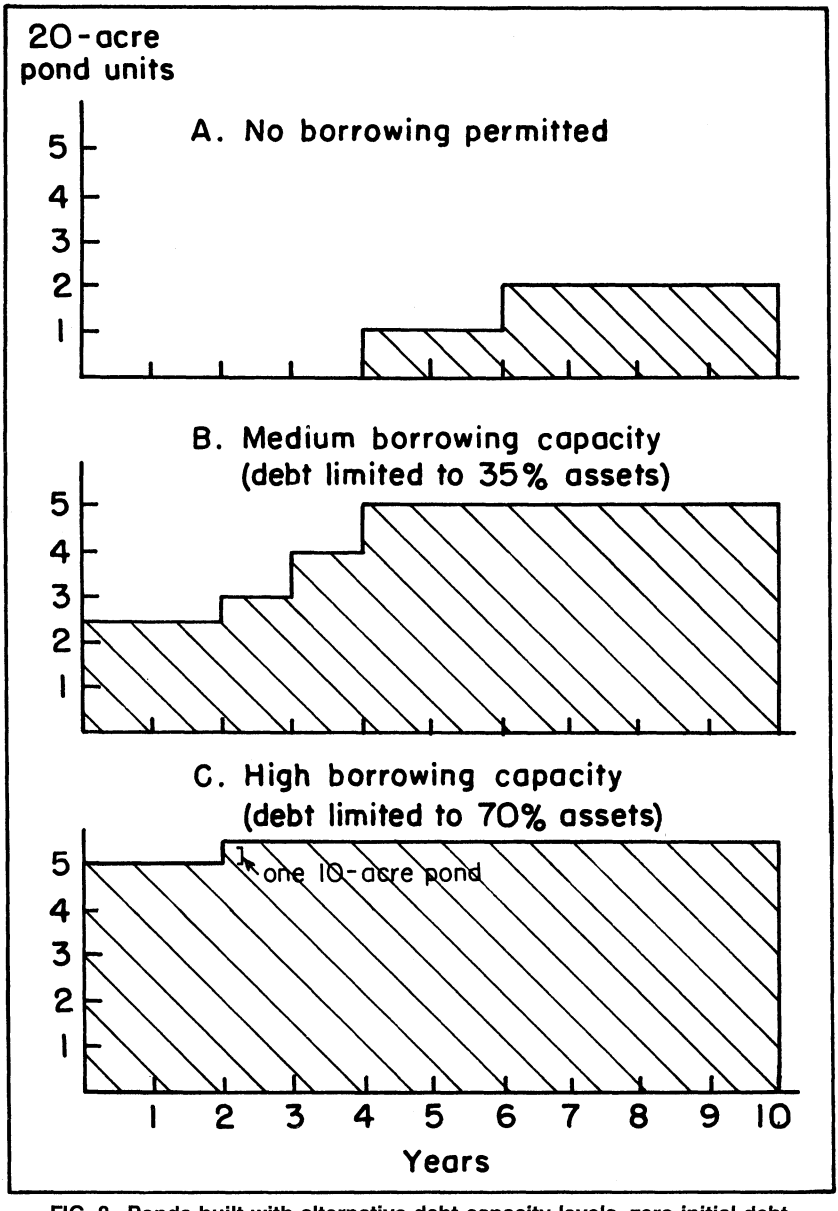

FIG. 8. Ponds built with alternative debt capacity levels, zero initial debt.

by the end of the planning horizon and net worth increased rapidly as debt was repayed.

Comparison of zero, medium, and high debt limits as they affected the buildup of net worth is shown in figure 9. The difference in the farm's financial health is surprisingly large, with end-period owner equity of $472,003, $683,851, and $724,150 for, respectively, zero, medium, and high debt capacity limits. Two lessons stand out: (1) until the third through the fifth years, maximum debt limit differences made relatively little difference in owner equity for the firm. This suggests one must have both staying power and patience to

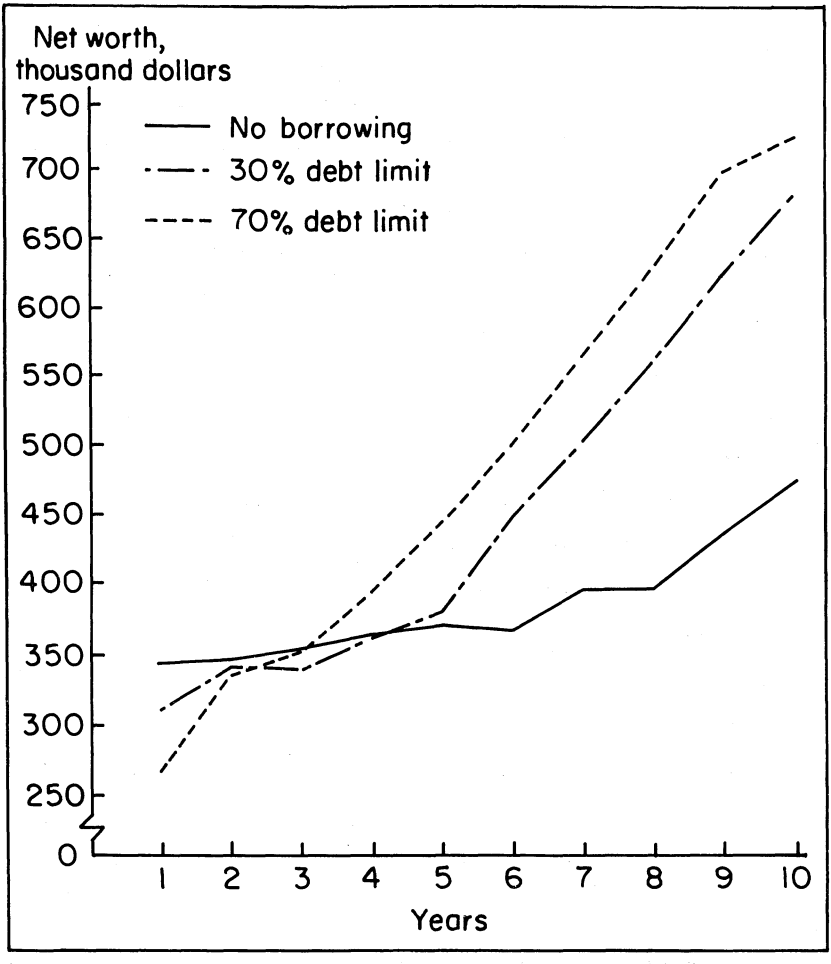

FIG. 9. Farm net worth over time for three borrowing situations.

continue the farm business until the profit generating effects of financial leverage are received. (2) The large difference between the moderate debt limit and no borrowing, combined with the much smaller difference between the moderate and high debt limits suggests that moderate use of debt achieved most of the benefits of borrowing, while limiting financial risk. In other words, while no borrowing severely limited the growth and profit prospects of the farm, moderate debt use proved to be very prudent given 1981 conditions depicted in the model.

SUMMARY AND CONCLUSIONS

Conversion of land to fishponds is viewed by some farmers to be an avenue for intensive farm growth. Most catfish farming in Alabama is likely to remain on diversified farms because of physical land characteristics that restrict conversion of entire existing farms to fishponds. Investment in fishponds is often an irreversible decision, and this raises questions about long-run ramifications of pond construction. Farmers, lending institutions, and government bodies with responsibility for providing information to prospective fish farmers, have had little economic information to guide decision making.

An optimization model that maximized profits and net worth was used to evaluate the conditions under which a catfish enterprise would become part of an optimal farm organization. A representative farm, characterizing a typical farm in seven counties of western Alabama, was developed from Census data and interviews with producers. The representative farm was assumed to be already engaged in rowcrop and beef cattle production. Cotton, soybeans, beef cattle, and catfish enterprises were considered in the model. Unique aspects of the soil and water conservation pond tax deduction were incorporated. The indivisible nature of ponds and the economies of size for pond construction and operating costs for the catfish enterprise were also incorporated. Three pond sizes were considered: 5-acre, 10-acre, and 20-acre.

Farmer's attitudes toward risk were evaluated in the context of zero, medium, and high debt capacity limits. Two levels of catfish stocking rate intensity and various levels of initial debt were also developed. In addition, management effects on ability to obtain top prices (or limit revenue losses due to inefficient production methods, diseases, or other such factors) and situations where pond building was limited to small ponds were also studied.

The catfish enterprise exhibited a strong tendency to enter the optimal farm organization when the 20-acre pond building alternative was available, capital was adequate, and a high management intensity was employed. When capital was rationed (or limited), however, smaller ponds were the only alternative, and the catfish enterprise was diminished or excluded from the farm organization. In the capital rationing case, reduced importance of catfish was caused by the large capital outlay needed to finance the indivisible 20-acre pond units. In the small pond case, the higher per-acre capital outlays and higher operating costs contributed to the poor catfish enterprise performance. The low (2,500 fish per acre) catfish stocking rate situation provided a lower return to capital and land, but returns were sufficient to allow the catfish enterprise to become an important part of the farm organization when capital was adequate. Under heavy initial debt loads the firm was never able to generate sufficient income to substantially reduce debt. The review of cases in table 2 shows that the catfish enterprise generally increased net worth by approximately 1-5 percent annually. For the "base case," which assumes superior management, catfish contributed $246,386 to net worth over the 10-year planning period.

Given the limitations of model assumptions, the following conclusions are drawn:

1. Catfish production can be an attractive mode for intensive farm growth when debt is small compared to assets, where large pond sites are available, and high stocking rates are employed.
2. The soil and water conservation income tax deduction should be claimed when feasible. This provision for pond construction stimulates firm growth by reducing the tax liability but does not alter the decision to invest in catfish production appreciably.
3. Investment in catfish ponds should be typically undertaken only when the farmer or investor has strong "staying power." It may take 3-5 years for catfish revenues to substantially contribute to farm profits.
4. Investing in catfish production by increasing leverage on assets with moderate existing debt enhances firm growth but creates a more vulnerable debt situation. Moderate leverage captured most of available profits due to borrowing, and it also limited risk exposure significantly.

5. Capital investment for catfish production can be generated internally; however, this method of finance restricted the pond construction rate significantly. Also, retained earnings were accumulated to purchase large pond units rather than smaller units.

6. Catfish profitability was severely impaired when gross revenues declined by 15 percent due to inefficient production practices, disease, or marketing of a low quality product. The same effect would result from a $0.10 decline in price to $0.55 per pound. This finding, based on 1981 conditions, suggests investment in catfish ponds is only advised when long run prices are expected to be at least $0.65 per pound and superior management is available.

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APPENDIX

ESTIMATED VARIABLE COSTS AND RETURNS FOR CATFISH PRODUCTION IN 20-ACRE "HILL" PONDS USING HIGH MANAGEMENT INTENSITY AND LOW MANAGEMENT INTENSITY[1]

Item	Weight each	Unit	Price or cost/unit	Quantity	Value or cost
High Management Intensity					
Gross receipts					
Catfish	1.00	lb.	.65	90,000.00	58,500.00
Total					58,500.00
Variable cost					
Fingerlings		each	.12	95,400.00	11,448.00
Floating feed		tons	310.00	81.00	25,110.00
Chemicals		appl.	1,350.00	2.00	2,702.00
Fuel, oil, and lube		hr.	2.16	444.00	959.04
Equipment (repair)		dol.			275.69
Total variable cost					40,995.73
Low Management Intensity					
Gross receipts					
Catfish	1.00	lb.	.65	50,000.00	32,500.00
Total					32,500.00
Variable costs					
Fingerlings		each	.12	53,000.00	6,360.00
Floating feed		tons	310.00	45.00	13,950.00
Chemicals	appl.		1,351.00	1.00	1,351.00
Fuel, oil, and lube		hr.	1.58	226.00	357.08
Equipment (repair)					147.88
Total variable costs					22,165.96

[1]Labor cost and interest charges are included in model. Fixed costs including machinery, pond investment, and overhead are not included. High and low fish stocking rates were defined respectively as 4,500 and 2,500 fish per acre.

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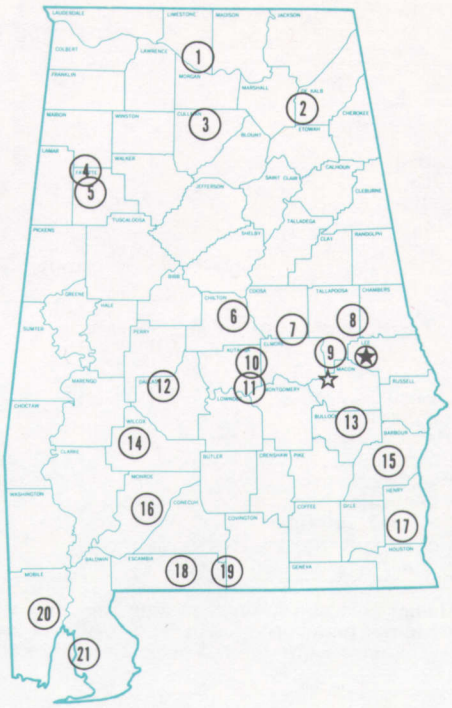

Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.
☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Chilton Area Horticulture Substation, Clanton.
7. Forestry Unit, Coosa County.
8. Piedmont Substation, Camp Hill.
9. Plant Breeding Unit, Tallassee.
10. Forestry Unit, Autauga County.
11. Prattville Experiment Field, Prattville.
12. Black Belt Substation, Marion Junction.
13. The Turnipseed-Ikenberry Place, Union Springs.
14. Lower Coastal Plain Substation, Camden.
15. Forestry Unit, Barbour County.
16. Monroeville Experiment Field, Monroeville.
17. Wiregrass Substation, Headland.
18. Brewton Experiment Field, Brewton.
19. Solon Dixon Forestry Education Center, Covington and Escambia counties.
20. Ornamental Horticulture Field Station, Spring Hill.
21. Gulf Coast Substation, Fairhope.