# VIII: FISH FARM MANAGEMENT

## INTRODUCTION

In Chapter 1, fish farming was defined as the raising of fish in managed unnatural aquatic ecosystems for profit. Figure I.1 illustrated the three basic components of fish farming market, production ecosystem and farm management. Markets are the objective of production for all fish farming enterprises and not unique to 80:20 pond fish culture. Farm management is the act of controlling or directing production to take advantage of a market. Markets are not subject to farm management control, but production systems are manageable, some to a greater degree and with greater flexibility than others. In this regard 80:20 technology is subject to greater management control than traditional pond technologies practiced in China.

Production technology management, or the management of production ecosystems, is the primary focus of this manual. However, because profit is the purpose of fish farming and markets are the objective of production, successful fish farm management for profit requires application of sound business management principles to maximize profits by matching market situations with optimized production options. Therefore, a brief discussion of fundamental principles and concepts of fish farm management are presented in this section to complement sections on production management and to emphasize the fact that profit, not production, is the purpose of fish farming.

## MANAGEMENT

The purpose of farm management is to combine all available resources, including capital, land, water, labor and management, to maximize farm profit. The basic functions of farm management are centered on deciding, planning and implementing a farm plan based on the three questions of what, how and how much to produce. These are discussed in the following paragraphs.

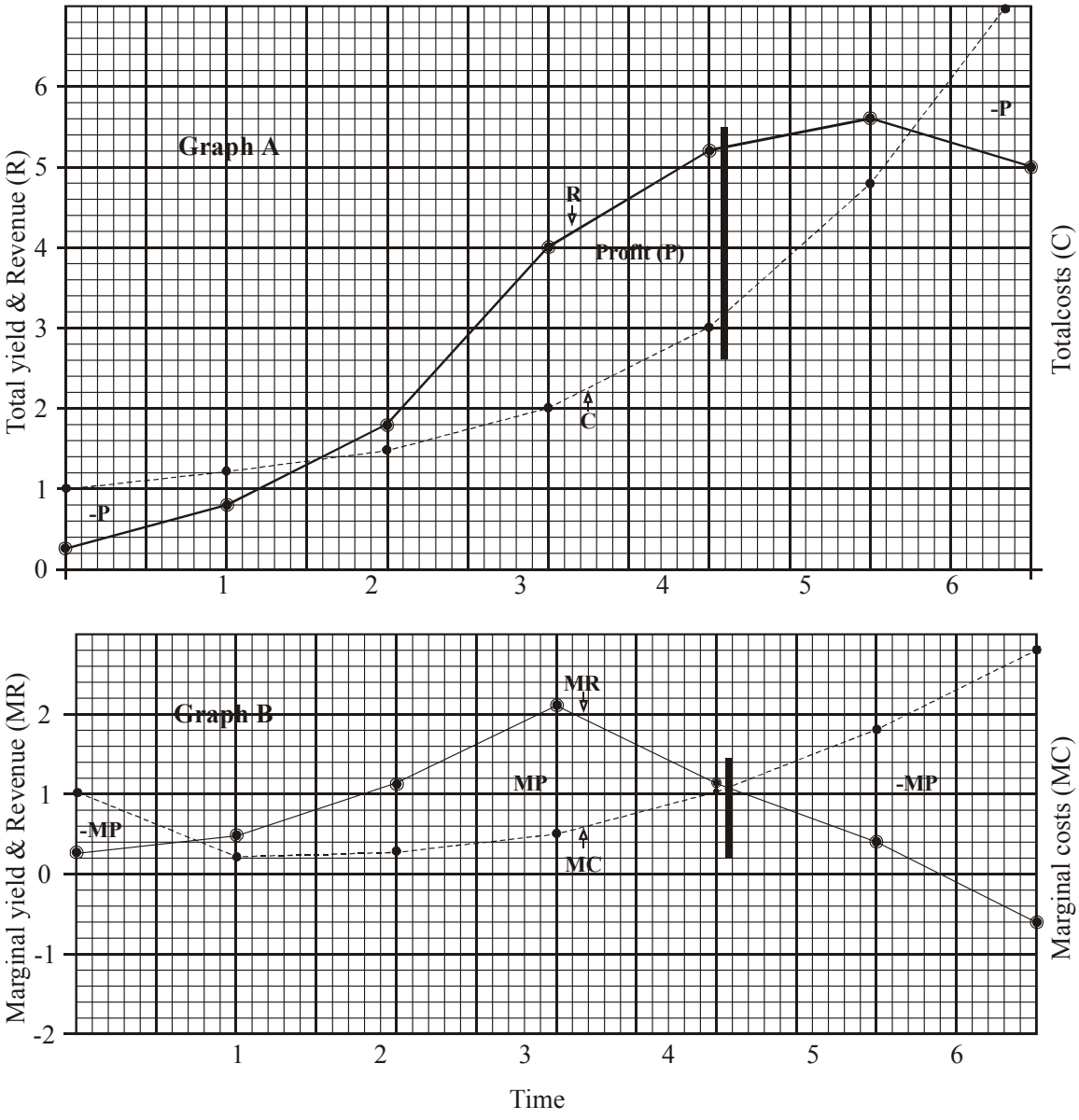
**What to produce** is determined by profit and not by production levels or use of resources. Profit is the difference between total cost of produced products and total revenues of the products sold. Therefore, management has two distinct categories on which to make decisions: 1) optimizing management intensity on the production side, and 2) maximizing potential revenues on the market side. Consequently, during pre-production planning, management must carefully analyze both market option potential, to decide what product to produce, and production technology, to decide how best to produce it. The products to produce in a specific 80:20 fish culture pond will obviously be a primary feed-consuming (80%) species and one or possibly more secondary (20%) service species. The 80% species will be selected based on both its market and production potential. The 20% species will be raised primarily for their service function to facilitate production of the 80% species and secondarily for their market potential. The question of what to produce must also resolve secondary decisions such as fish size, color, form and other product characteristics that influence market price. The choice of

what to produce is entirely a judgment decision of management based on maximum acceptable margin of profit relative to maximum acceptable risk. Budgeting, the systematic listing of all costs and non-market resources used (inputs such as unpaid family labor) for each production system is essential for decision making.

**How to produce** is a question of what technology system, including component options, to employ to produce the fish product(s) chosen for the market. The general concept is to use a technology that is technologically feasible and cost effective in producing the chosen fish. An inferior method or input may make profit but not be as efficient, therefore, as profitable as an alternative. For example, in China traditional pond technology might be the technology of choice for producing silver carp while 80:20 might be the technology of choice for producing crucian carp. Also, if within a technology system a different method or input can be used to produce a higher fish yield (output) than the original or the same yield at a lower cost, then a change to the alternative method or input should be made if the change results in greater added revenue than added cost.

Farm managers have limited flexibility of managing costs. Capital costs for ponds, buildings and other fixed cost items are not changeable with technology systems and levels. For example, once a pond is constructed its cost remains the same regardless of whether traditional, 80:20 or another production technology system is used or if 10,000 or 10 fish are stocked. Managers do have the option of allocating share costs for ponds and other long-life fixed cost items into portions spread over the life of the item. Managers have flexibility in managing costs of fish stock, feed, labor, water management and other variable cost inputs. Variable costs change directly with level of production. For example, stocking 10,000 fish/ha will cost twice as much as stocking 5,000 fish.

The law of diminishing returns states that addition of inputs to a given production system will increase production yield as inputs are increased, first at an increasing rate, then at a decreasing rate, then yield will fall. Inputs after a point will become harmful to the system and total production will decrease. The additional yield due to each additional unit of input is termed marginal yield. Marginal revenue is the value of marginal yield, while the cost of each additional unit of input is marginal cost. It is marginal revenue, when compared to marginal costs, on which management decisions are made. Farmers should add input and increase production only to the point where the marginal benefit, the value of each additional unit of yield, is greater than the marginal cost of each additional unit of input. The optimal level of production is where marginal benefit is equal to marginal cost. In practice the optimal production point is difficult to project, because both marginal benefit and marginal cost are difficult.




| Time | R | C | P | MR | MC | MP |
|---|---|---|---|---|---|---|
| 0 | 0.3 | 1.0 | -0.7 | 0.3 | 1.0 | -0.7 |
| 1 | 0.8 | 1.2 | -0.4 | 0.5 | 0.2 | 0.3 |
| 2 | 1.9 | 1.5 | 0.4 | 1.1 | 0.3 | 0.8 |
| 3 | 4.0 | 2.0 | 2.0 | 2.1 | 0.5 | 1.6 |
| 4 | 5.2 | 3.0 | 2.2 | 1.2 | 1.0 | 0.2 |
| 5 | 5.6 | 4.8 | 0.8 | 0.4 | 1.8 | -1.4 |
| 6 | 5.0 | 7.6 | -2.6 | -0.6 | 2.8 | -2.2 |

Figure VIII-1. Illustration of the law of diminishing returns as it relates to the concept of marginal cost and marginal revenue.

to determine in advance. Farm managers must understand that additional inputs beyond optimal production level may increase yield, but the value of the additional yield is less than additional cost. An example of the law of diminishing returns as it relates to marginal cost and revenue concept is illustrated in Figure VIII-1. Graph A shows a typical production curve (R) with increasing yield over time. Only one curve (R) represents both yield and total potential revenue, because a direct relationship is assumed. Maximum yield and potential revenue were achieved at 5.6 units and 5.0 time units. Graph A also shows the relationship over time between total potential revenue (R) and total cost (C). The space between R and C represents profit. Note on the cost curve that at time of stocking (0.0 time), yield level is 0.3 units (weight stocked) but cost level is 1.0 units and negative profit, because of start-up costs, such as for land and pond construction, pond preparation and fish stock were incurred before any fish were actually produced. Also note that R declined after 5.0 time units, and C accelerated after about 3.0 time units, and the two curves intersected at near 5.2 time units beyond which negative profit increased. Graph B shows the relationship over time between marginal cost (MC) and marginal revenue (MR). In this example optimal production is at 4.1 time units where MR and MC are equal and profits, therefore, are maximum, as indicated also in Graph A.

**How much to produce** must be determined on the basis of both per pond area and per farm. How much to produce per pond area is a matter of optimum yield as discussed about the law of diminishing return in the previous paragraph. How much to produce per farm is a matter of deciding what fishes will be produced and then allocating total pond area of the farm to each based on its share of the total area. For example, a farm manager has a total of 50 ha of ponds and wants to produce 3 different primary (80%) fish species at a ratio of 2:2:1; therefore, he would allocate 20 ha to each of 2 species and 10 ha to the other. A farm manager should produce species where profits are highest. However, market limits, resource limits and the need to spread cash flow are considerations in choosing fish species.

In summary, a fish farm manager must decide what, how and how much fish to produce to maximize farm profit. What to produce is primarily a function of market demand and price, and secondarily the ability of the farm to efficiently and competitively produce the selected fish. How to produce is primarily a function of applying a technically sound, cost effective and competitive production system. How much to produce is a function of maximizing marginal profit between market price and optimal production cost.

Market price is determined through quantity of product supplied to the market and the quantity of product demanded by the market. Generally with farm products, producers have to view market prices as something beyond their control, but should be aware of what controls them. Demand is influenced by many factors, including tastes and traditions of consumers and availability of competing products. Supply is affected by such things as market expectations, and supply and cost of inputs are also affected by markets. For example, a new factory opening in the area may draw labor away.