

Farm Pond Management: Increasing Production through Fertilization

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Introduction

In recent years, many farmers and landowners have become interested in revitalizing their farm ponds. Their goal is to increase production in these ponds and produce large poundages of bass and bluegill. Good fishing ponds, however, do not just happen — they require good management and sometimes considerable time and effort.

This fact sheet focuses on one aspect of good management, pond fertilization; other considerations include pond renovation, elimination of existing fish populations and restocking. Information on pond renovation and population control can be obtained from the county Cooperative Extension Service offices throughout Maryland, or the Sea Grant Extension Program. Other sources of information are Maryland's Department of Natural Resources and the Soil and Water Conservation District Offices throughout the state.

It is important to remember that some ponds may be naturally fertile and do not need to be fertilized. Fertilization should not be undertaken



under any circumstances unless owners wishing to increase their pond productivity are committed to long-term management.

Why Fertilize Farm Ponds?

Fertilization is one of many methods of managing your pond for recreational fishing. Because the number of fish that can be produced in a pond greatly depends on water fertility, fertilization may improve the quality of fish growth, if the water-

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shed in which your pond is located is poor in natural nutrients. However, while fertilization can benefit your farm pond, improper management can lead to significant problems such as excessive aquatic vegetation or oxygen depletion.

Fertilization of ponds has been done for centuries. Chinese fish farmers used fertilization techniques over 2,000 years ago in carp culture. In the United States, fertilization has been used extensively since 1925

and is a basic means for increasing pond productivity. That productivity can be increased three to four times more than a nonfertilized pond, depending on natural soil and water characteristics. Well fertilized, well managed ponds can yield 400 pounds of fish per acre per year, while nonfertilized ponds usually produce about 100 pounds per acre per year.

The addition of fertilizer helps promote the growth and production of phytoplankton, microscopic plants that are at the base of the food chain. Phytoplankton utilize sunlight and the nutrients in fertilizers; they are usually responsible for giving a pond its green color, commonly termed a "bloom."

Phytoplankton are eaten by microscopic animals such as zooplankton, some insects and small fish. Larger fish feed on the zooplankton, insects and smaller fish. Thus, as production of phytoplankton increases, so should the production of bigger fish.

In well-constructed ponds, proper fertilization procedures can also be an effective means for controlling rooted aquatic vegetation. In properly fertilized ponds, the bloom becomes so dense it limits the amount of sunlight that reaches the pond bottom and because plants need light for photosynthesis, the lack of light limits the growth of submerged aquatic vegetation. However, improper or infrequent fertilization procedures, and improperly constructed ponds (for example, ponds with a large amount of water less than 2 feet deep), can have the opposite effect and cause major aquatic vegetation problems.

If you plan on fertilizing your pond, you will have to consider a

number of factors, among them: (1) depth, (2) the amount of shoreline, (3) overall size of the pond, (4) the rate of water exchange, (5) how much you intend to fish the pond and (6) whether there is a standing population of rooted aquatic vegetation. Chemical factors such as the pH and alkalinity of pond water, as well as the nutrients present in the soil and water, may be important. Economically, you must consider whether the cost of fertilizing the pond will increase its value, or if the increased satisfaction you gain from the additional management is worth the cost.

Should Every Pond Be Fertilized?

While the addition of fertilizers can increase the productivity of a given pond, just how much that increase will be depends on factors which have already been mentioned. Just like farmers who work the soil, each pond owner should develop a best management practice protocol, and, in some cases, fertilization is not among these protocols.

1. Fertilization may not necessarily increase the size of individual fish, though it can help increase the total poundage. Proper stocking and harvesting techniques are required to increase fish size. For example, if a one-acre pond had 100 pounds of two- to three-inch bluegills and few to no large-mouth bass, fertilization would probably result in 300 to 400 pounds of two- to three-inch bluegills and still only a few large-mouth.
2. Ponds with excessive water flow should not be fertilized. In ponds such as these, you are probably wasting time and contributing to nutrient overload, or enrichment,

in waters downstream from your pond. As a general rule, if the total volume of water flowing out of a pond in 30 days exceeds the total pond volume, you should not fertilize. The added nutrients will probably not be in the pond long enough to develop adequate blooms.

3. Ponds with extensive areas less than two feet in depth should not be fertilized. The addition of nutrients will only worsen the problem with overgrowth of aquatic vegetation. Even with a good bloom, sufficient sunlight will reach the pond bottom and promote rooted vegetation growth.
4. Ponds without a history of aquatic vegetation problems, and which are subjected to very light fish harvests, should not be fertilized. Why increase the production of fish if only a very few are going to be harvested?
5. Ponds that are used for commercial fish culture should not be fertilized. Added nutrients from fertilizers, coupled with wastes associated with feeding, could lead to excessive phytoplankton blooms and result in depletion of dissolved oxygen levels and fish kills.
6. Ponds that have acidic soils should not be fertilized before proper liming. Application of phosphate fertilizers to ponds with acidic soils is a waste of time and money. Proper liming allows the phosphorus to be available to the phytoplankton and not become bound up on the soil.
7. Ponds that are constantly muddy should not be fertilized. Phytoplankton require sunlight for

growth and if the pond is constantly muddy, it is most likely that insufficient sunlight is penetrating the water to allow proper phytoplankton blooms to develop. Muddy fresh water can usually be cleared up with applications of gypsum at rates of 25 to 35 pounds per 1,000 cubic feet.

Types of Fertilizer

Fertilizers may be organic or inorganic. They each contain varying amounts of nitrogen, phosphorus and potassium. A complete fertilizer usually is one that contains all three nutrients missing. It is usually the inorganic types of fertilizer that are used for farm pond management programs, while organic fertilizers are more frequently used in the aquaculture of larval fish where rapid promotion of zooplankton production is needed.

Of the nutrients found in inorganic fertilizer, potassium contributes little to phytoplankton production so it is often left out of farm pond formulations. Likewise, when a fresh water pond becomes overly-rich with nutrients, unwanted algae such as filamentous blue-green algae can dominate a pond. In cases such as these, it is best to use an incomplete inorganic fertilizer (one void of nitrogen) or no fertilizers at all. However, in early spring, at the time of first fertilization, or newly constructed ponds, you may wish to use a complete fertilizer.

Inorganic Fertilizers

These are chemical fertilizers which contain nutrients either alone or in combination to make a mixed fertilizer. The composition is always expressed in order of nitrogen, phos-

phorus and potassium. (For example, a 20-20-5 fertilizer will have 20 percent nitrogen, 20 percent phosphorus and 5 percent potassium.) Inorganic fertilizers come in either granular or liquid form. Granular fertilizers have different forms and vary in their effectiveness, cost and ease of application. Liquid fertilizers are easier to use but are usually harder to obtain. In contrast to granular forms, they are usually more available to the plant for uptake because the fertilizer is already in solution.

Nitrogen is an element of basic protein and is a part of all living cells. Expressed as N, it may be present as nitrate, ammonium or urea. Nitrogen is usually not a limiting factor in the production of plankton in freshwater ponds, as it is almost always present in sufficient amounts through natural processes (e.g., animal wastes, decomposition).

Phosphorus is present as phosphate, expressed as P_2O_5 or phosphoric pentoxide. It is considered the most essential element in fresh water fertilization program because it aids in plant respiration and helps to stimulate root production. It is usually the limiting nutrient in sportfish ponds, which means it is the one nutrient that inadequate quantities are available to maintain or maximize plant growth. Clay and organic matter in a pond may adsorb to phosphorus molecules, binding them up and making them unavailable as a pond nutrient.

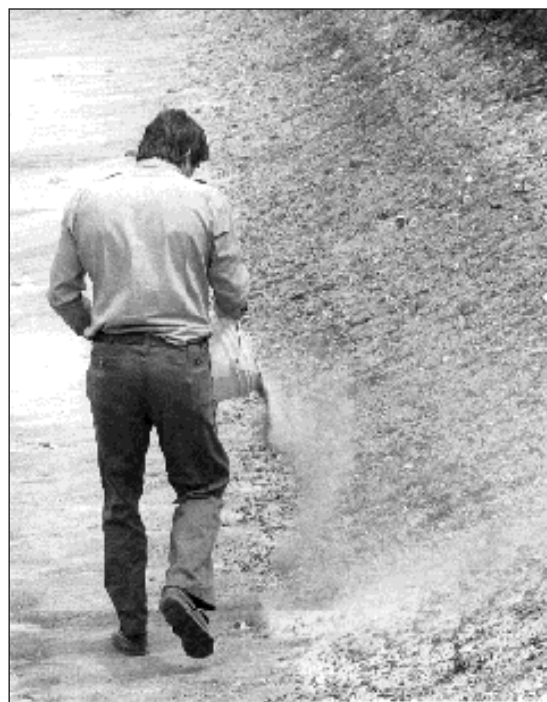
Potassium (K) is expressed as KO or potassium monoxide. Acting as a cata-

lyst in plants, although needed at lesser levels than the other nutrients, potassium is used in the plant's manufacture of carbohydrates. It tends to move from the bottom mud to the water and plants readily.

Organic Fertilizers

Organic fertilizers are natural substances such as hay, alfalfa, or manure. Most waste materials have been used at some time or another. These fertilizers tend to accelerate the production of zooplankton or other microscopic animals on which many fish feed more rapidly than inorganic fertilizers. They can also be used effectively in cleaning waters which have high silt loads in them.

Organic fertilizers contain low levels of nitrogen, phosphorus and potassium compared with inorganic fertilizers; thus, larger quantities must be added to effect the same level of nutrients as inorganic fertilizers. Organic fertilizers are a more expensive source of plant nutrients



because they require much more labor and they require much more handling to deploy them. They have a shorter production cycle than inorganics and may lead to increased filamentous algae growth.

Ideal organic fertilizers should have a low carbon to nitrogen ratio (C:N) and a small particle size. Organic fertilizers with low C:N are better utilized by plants and animals in the pond. Manures, for example, have high C:N and do not decompose rapidly. Thus, concentrations of organic material build up on the pond bottom and can lead to water quality problems. In general, with the exception of clearing up turbid ponds, organic fertilizers are not used in sportfish ponds.

Reading the Label

Fertilizer manufacturers place the percentages of the primary nutrients on the label; these are known as fertilizer grade. For example, a fertilizer grade of 10-10-10 consists of ten percent nitrogen, ten percent phosphorus and ten percent potassium. The remaining 70 percent is a filler, usually agricultural limestone. This filler is often added to reduce the acidity because most fertilizers are acidic in their raw form.

Common incomplete granular fertilizer sources are normal superphosphate (0-20-0), triple superphosphate (0-46-0) and diammonium phosphate (18-46-0). Examples of complete fertilizers are 10-10-10, 20-20-5 and 4-12-12.

Liquid fertilizers are more efficient than granular because they are already in solution and the fertilizer disperses rapidly, thus requiring smaller applications -- these factors may reduce the cost of pond fertilization. Some common liquid fertil-

izers are liquid urea (45-0-0), phosphoric acid (0-54-0), and ammonium polyphosphate (10-34-0). Mixed liquid fertilizers are usually in a 1:3 ratio.

If a liquid fertilizer is unavailable, granular fertilizers may be mixed with water and poured over the surface as a slurry. **Liquid fertilizers are caustic and heavier than water; therefore, always add acid to water and not the reverse.**

Fertilization Schedule

It is important that once you initiate a fertilization program, you should continue it throughout the summer or problems with vegetation, stunted fish populations and water quality could result.

Ponds in Maryland should be first fertilized in mid-April, when the water temperature reaches 65 F; it should be continued through the summer until mid- to late-September, when the water temperatures decline to 65 F. Follow the initial fertilization application with additional treatments every two weeks until the ideal bloom has developed. A measure of water clarity can assist you in doing this.

Attach a flat white object (i.e., the bottom of a chlorine bottle) to a pole and inscribe inches on the pole. The object should disappear at about 18 inches beneath the surface. In general, you reapply fertilizer when you can see an object 22 inches beneath the surface. If the object disappears in less than 12 inches, there are too many phytoplankton in the pond and you should stop fertilizing until the water clarity returns to about 22 inches.

Maintaining proper blooms may require you to fertilize as much as every 10 days or as little as 3 times

during the summer. Frequency will depend on natural fertilization of the pond the amount of water flow through the pond, and the type of fertilizer used. Remember that these general rules relate to the green color of the water which develops from phytoplankton abundance. If the pond is muddy, or has a dark stain associated with runoff from wooded lots, the fertilization program probably will not work.

Amount of Fertilizer

There are a variety of methods and types of fertilization programs that can be used, and all are effective if the pond soil pH is in an acceptable range.

The standard fertilization rate per acre for warm water fish ponds is 100 pounds of 8-8-2, 50 pounds of 16-16-4, or 40 pounds of 20-20-5. The key in fresh water is the amount of phosphorus in the fertilizer. For granular fertilizers, you can use a simple formula for determining the amount of a given grade to use: multiply 8 times 100 and divided by the middle figure in the fertilizer analysis. For example, assume you purchased a bag of 20-20-5 and you have a 3-acre farm pond. You first determine how much 20-20-5 is needed per acre:

For a 3-acre pond, multiply 3 times 40 pounds/acre, or 120 pounds of 20-20-5 for your pond.

Because liquid fertilizers are already in solution, it usually requires only one gallon per acre of liquid diammonium phosphate (10-34-0) to meet the needs of the plants. Since liquid fertilizers are also heavier than water (about 12 pounds per gallon for the fertilizer compared with 8.3 pounds for water), it is essential to dilute liquid fertilizers before appli-

cation. It is easiest to dilute liquid fertilizers with five parts water to one part fertilizer. Remember: Pour acid into water, not water into acid.

After several years of fertilization (three to five years), it may not be necessary to fertilize with complete fertilizers. Is it probably best to discontinue the use of nitrogen and potassium and just continue with phosphorus. See Table 1 for guide to phosphate fertilizers.

How to Apply the Fertilizer

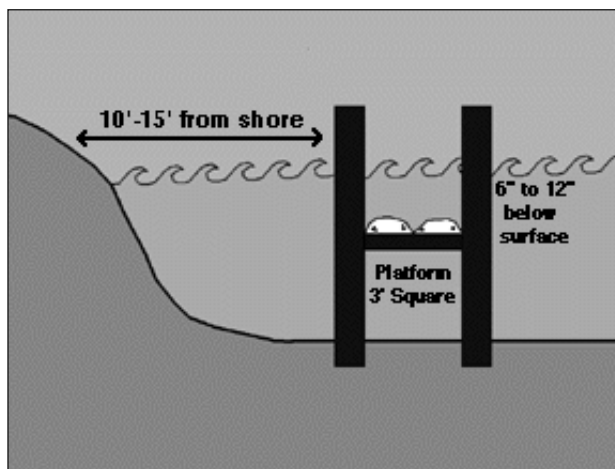
In general, liquid fertilizer should be spread over the entire pond surface — remember to dilute it with water before application. Usually the label on the fertilizer will specify application procedures.

For both liquid and granular forms, you will want to make sure

$8 \times 100 / \text{middle figure in analysis} =$
pounds of fertilizer per surface

$8 \times 100 / 20 = 40$ pounds per acre

fertilizer does not come in contact with the pond bottom this is because nutrients may become bound up in the soil. Granular fertilizers should be dispersed by using a fertilizer platform: placed 6 to 12 inches below the surface near the pond edge, water and wave action will dissolve the fertilizer slowly and mix the nutrients throughout the pond. Place the sacks of fertilizer on the platform and slit the bags open in an H pattern. Peel back the center flaps



A fertilizer platform is an efficient method of application.

and allow the contents to be exposed to the water. One platform should be sufficient for up to 15 acres if the platform is placed at the upwind edge of the pond.

If you do not have a platform in the pond, you can broadcast the fertilizer throughout the pond by boat. Spread the fertilizer by hand in shallow water (3 feet or less in depth). Another alternative is to slit the bags as mentioned above and place them in shallow water along the pond edge around as much of the pond as possible. The latter two methods are the least desirable as they increase the chances of fertilizer coming in contact with pond soils.

Common Mistakes in Fertilization

- **Failure to maintain adequate blooms throughout the season**

A poor, infrequent fertilization program is worse than no fertilization program at all. Infrequent fertilization can result in fluctuations in the food chain and, therefore, food that is available to the fish populations. Infrequent fertilization can also add to aquatic weed problems.

- **Waiting too late in the spring to begin fertilization**

Once rooted aquatic vegetation begins to become established in a pond, you should not fertilize. The addition of inorganic nutrients at this time will only result in worsening the aquatic vegetation problems and wasting money. Once rooted aquatic vegetation has reached the surface, they can no longer be controlled by fertilization. First treat the pond with an approved herbicide to eradicate the rooted vegetation -- then apply fertilizers accordingly. (See Aquatic Plant Identification and Management Workbook Series)

- **Failure to check total hardness (liming requirements)**

The total hardness of the pond and soil pH should be checked every 3 to 5 years. If liming is required, apply at the recommended rate and that should improve the ability of the pond to develop adequate blooms. (see Liming Aquaculture and Farm Ponds in Maryland, #7 in Finfish Aquaculture Workbook Series)

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