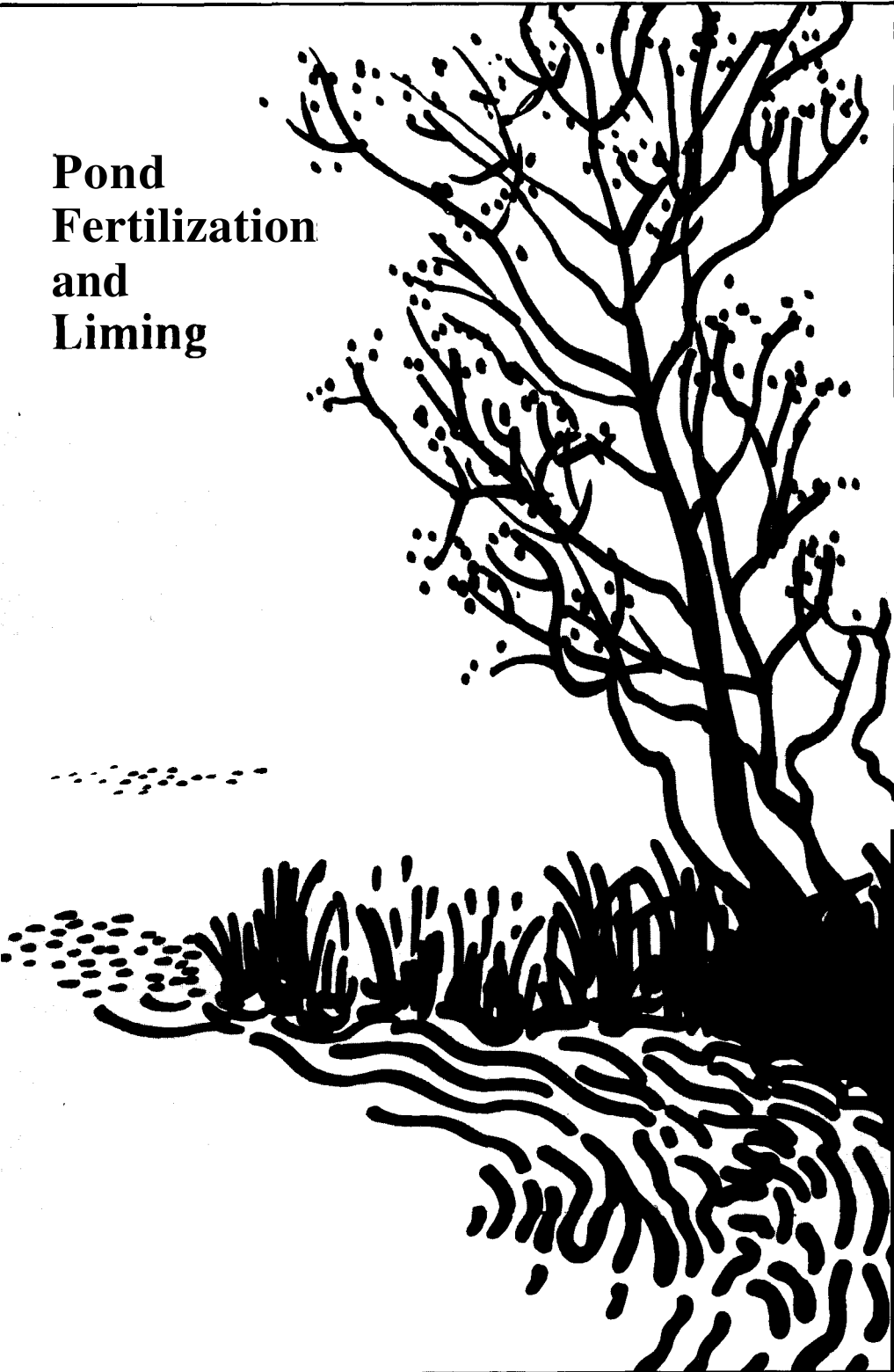


Pond Fertilization and Liming



FERTILIZATION AND FOOD CHAIN

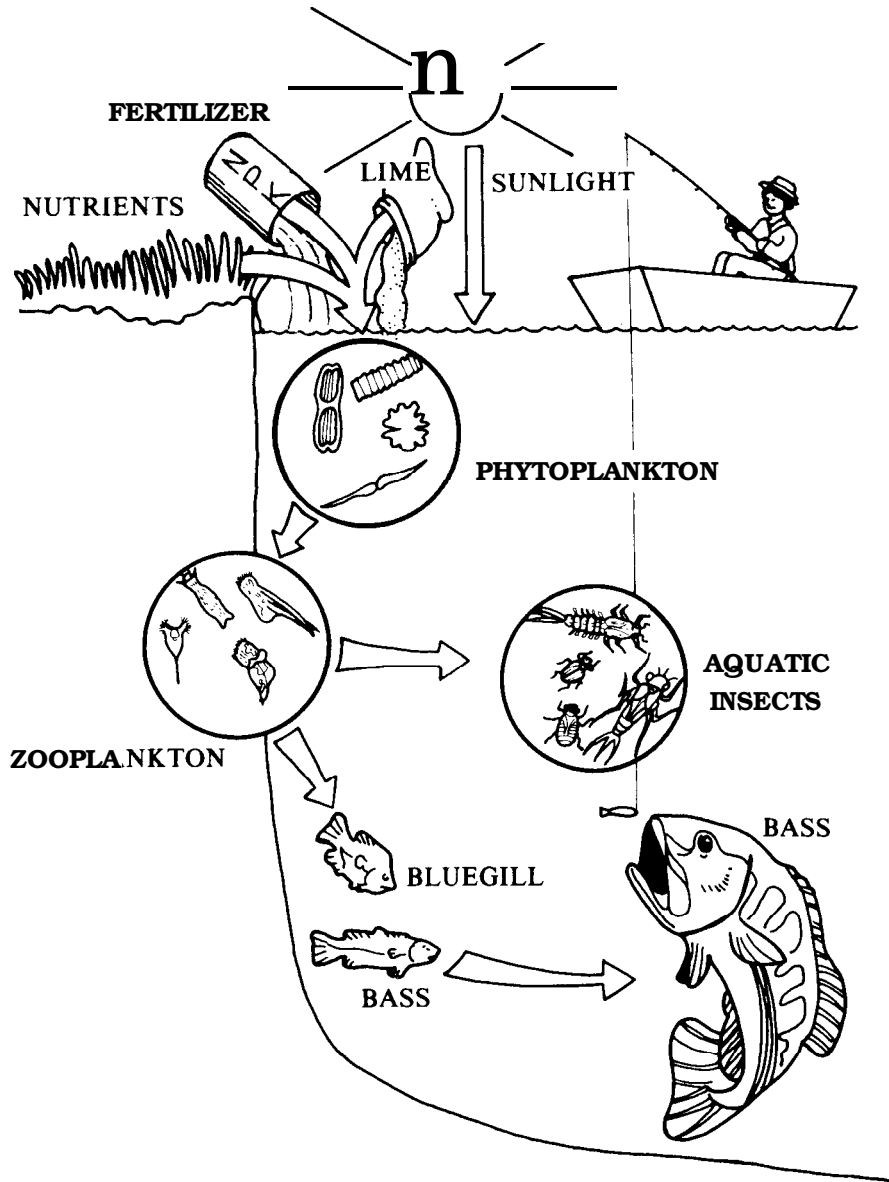
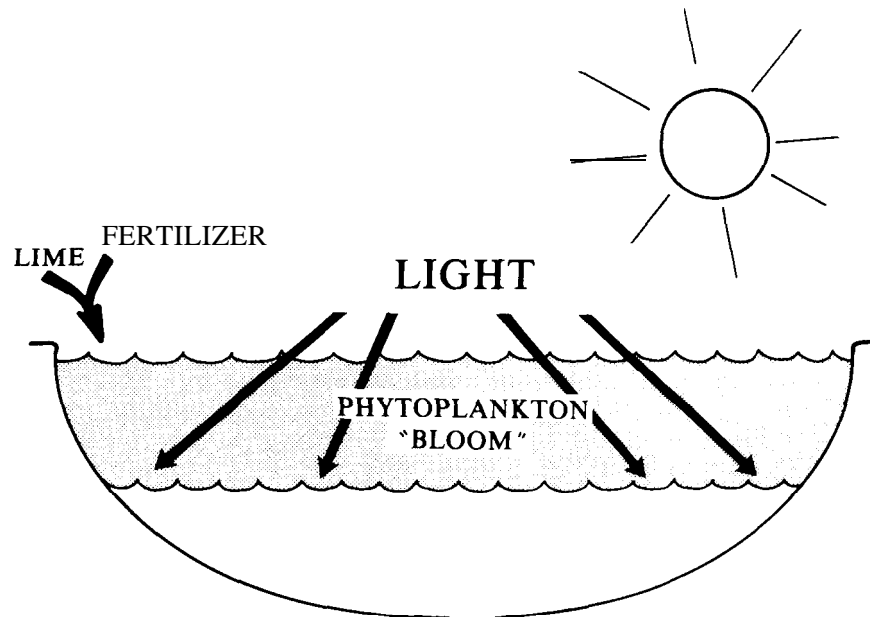


Figure 1. A typical food chain, from nutrients and sunlight to large predator fish (bass) in a sportfishing pond.

Pond Fertilization and Liming

Proper fertilization and liming can increase three to four times the pounds of **fish** a pond will support. Unfertilized ponds stocked with bream, bass and catfish usually have about 100 pounds of **fish** per surface acre. Ponds receiving adequate amounts of fertilizer typically contain 300 to 400 pounds of fish per surface acre. Fertilization increases **fish** production by increasing the amount of microscopic green plants (phytoplankton) in the water. Phytoplankton is the base of the pond food chain (figure 1). The green color characteristic of fertilized ponds, called a bloom, is due to the abundance of phytoplankton. Phytoplankton is consumed by zooplankton (microscopic animals), which is eaten by aquatic insects and small fishes. The small fishes serve as food for the larger predators, such as **large-mouth bass**:

In properly constructed ponds, an adequate fertilization program helps control rooted aquatic weeds. In properly fertilized ponds the microscopic green plants become so abundant that the phytoplankton bloom limits sunlight penetration deeper than about 18 inches. This shading of the deeper water prevents rooted green plants (which must have sunlight to grow) from becoming established (figure 2).



*Figure 2. A good phytoplankton bloom, encouraged by proper fertilization, limits sunlight **penetration** to 18 inches from the surface. This in turn inhibits rooted aquatic weed development on the pond bottom.*

Most aquatic weeds die or become dormant during the winter. If the pond is properly fertilized and an appropriate phytoplankton bloom is established before spring weed growth begins, the weeds will not become reestablished. If rooted aquatic vegetation has reached the surface (or near the surface) of the water prior to initial fertilizer application, many of the nutrients contained in the fertilizer will be taken up by the weeds. If this occurs, fertilization will encourage the growth of aquatic weeds.

Should Every Pond Be Fertilized?

Although fertilization can increase fish production significantly, it is not the best management practice for every pond.

1. Fertilization alone will not necessarily increase the size of individual fish in the pond. It will increase the total pounds of fishes in the pond. If a one acre pond had 100 pounds of two to three inch bluegills, with few or no largemouth bass, fertilization would probably result in 300 to 400 pounds of two to three inch bluegills.
2. Ponds which have excessive water flow cannot be efficiently fertilized. If the total volume of water flowing out of a pond in 30 days exceeds the volume of the pond, it usually is not practical to fertilize. The added nutrients will not be in the pond long enough to promote the desired phytoplankton bloom. All ponds may have excessive water flow in the wet seasons (spring and fall). Ponds which exchange their water volume in 30 days or less in the dry season (summer) should not be fertilized.
3. Do not fertilize ponds with extensive areas less than two feet deep. The added nutrients will promote the growth of undesirable rooted aquatic vegetation in areas where sunlight penetrates to the bottom.
4. Do not fertilize ponds with no history of weed problems and very light fish harvests. It serves no purpose to increase pounds of fish in the pond if very few are going to be harvested.
5. Do not fertilize commercially fed ponds. Added nutrients promote excessive phytoplankton blooms that could lead to dissolved oxygen depletions, resulting in fish kills.

Inorganic Fertilizers

Use only inorganic fertilizers in sportfishing ponds. Use of organic fertilizers, such as animal manures, is discouraged since it often promotes development of undesirable algae. It is also difficult to determine and control the amounts of various nutrients added in organic fertilizers. Inorganic fertilizer manufacturers are required to list contents as percent nitrogen (N), phosphorus (P) and potassium (K). For example, a complete fertilizer (one that contains all three nutrients), labeled 20-20-5 contains 20 percent N, 20 percent P, and 5 percent K. A good phytoplankton bloom can be achieved with either granular, liquid inorganic, or slow release fertilizer.

An incomplete fertilizer (one in which at least one of the nutrients is missing), labeled 9-30-0 contains 9 percent N, 30 percent P, and no K. A good phytoplankton bloom can be achieved with either granular or liquid inorganic fertilizer. Currently, it costs less to achieve similar blooms with commercially available liquid pond fertilizer than with granular. A “typical” fertilization program using liquid fish pond fertilizer costs 30 to 50 dollars per surface acre per year, while the same program using granular fertilizer costs 50 to 80 dollars per surface acre per year.

Which Inorganic Fertilizer Should You Use?

Phosphorus is usually the limiting nutrient in sportfishing ponds. The percent phosphorus in an inorganic fertilizer is the middle number in the fertilizer formulation. Application rate for granular fish pond (20-20-5) fertilizer is 40 pounds per surface acre per application. Application rate for liquid fish pond (9-30-0 or 10-34-2) fertilizer is one gallon per surface acre per application. Depth of water does not matter. The actual amount of phosphorus added using recommended rates of liquid fertilizer is not the same as that added using granular fertilizer. The phosphorus in the liquid fertilizer is more available to the phytoplankton and seems to go into solution more efficiently. Other fertilizer formulations can be substituted for the labeled fish pond fertilizer. At the recommended application rate of 40 pounds of 20-20-5 per surface acre per application, eight pounds of phosphorus is added each application (20 percent times 40 pounds equals eight pounds).

The following formula can be used to determine the amount of other granular fertilizer formulations equivalent to 40 pounds of 20-20-5:

$(8 \times 100) / \text{Percent of phosphorus in substitute fertilizer} = \text{Pounds of fertilizer per surface acre per application}$

For example, if 10-10-10 fertilizer is substituted for 20-20-5, the required rate would be 80 pounds per surface acre per application.

$(8 \times 100) / 10 = 80 \text{ pounds per surface acre per application}$

Several fertilizer formulations have been substituted for the standard fish pond fertilizer. Table 1 lists other fertilizer formulations and application rates that have been successfully used in sportfishing ponds.

Although some of these fertilizers could be purchased in bulk (at least two tons) at considerable savings, most ponds are not large enough to warrant it.

In most new ponds, use a complete fertilizer (one containing N, P, and K). Usually, after a pond has been fertilized for three to five years, potassium builds up and can be deleted from the application. Nitrogen is often “fixed” by algae and this nutrient may be deleted also. If incomplete fertilizers (missing at least one nutrient) do not produce a sufficient phytoplankton bloom within seven to ten days, resume using a complete fertilizer.

Table 1. Some Fertilizers and Application Rates Successfully Used in Sportfishing Ponds

<i>Fertilizer</i>	<i>Pounds per Acre per Application</i>
1. Fish pond fertilirer (20-20-5)	40
2. Diammonium phosphate (18-46-0)	18
3. Liquid ammonium polyphosphate (10-34-0)	20
4. Liquid ammonium polyphosphate (13-38-0)	20
5. Ammonium nitrate (34-0-0) plus triple superphosphate (0-46-0)	42
6. Ammonium nitrate (34-0-0) plus superphosphate (0-20-0)	64
7. Triple superphosphate (0-46-0)	18
8. Superphosphate (0-20-0)	40

When and How Often Should You Fertilize?

Begin fertilization in February or March when surface water temperatures stabilize above 60 degrees F. Establish a bloom as early as possible to prevent aquatic weed growth. For initial applications (until a bloom develops) use 80 pounds of granular (20-20-5) or its equivalent, or two gallons of liquid (9-30-0 or 10-34-2) or its equivalent per surface acre per application. Once a bloom is established, use 40 pounds of 20-20-5 or one gallon of 9-30-0 per surface acre per application. The new slow release pond fertilizer requires only one application in the spring. This type of fertilizer is resin-coated and will slowly release fertilizer during the warm weather months.

Repeat fertilizer applications every two weeks until a satisfactory bloom develops. If a satisfactory bloom does not develop within two weeks after the third application, have pond water analyzed for total hardness (lime deficiency), check for excessive flow, excessive rooted aquatic vegetation, or other possible reasons for lack of response. Once a satisfactory bloom has been established, repeat applications when visibility exceeds 18 to 20 inches. If the bloom is so green that visibility is less than

12 inches, do not fertilize. Excessive fertilization can lead to oxygen depletions, resulting in fish kills.

Maintain a satisfactory bloom from early spring through fall. Apply fertilizer until October or November when water temperatures stabilize below 65 degrees F. Most ponds require several (six to 10) applications per year.

Each pond differs in the number of fertilizer applications required to maintain a satisfactory bloom. In a properly fertilized pond, visibility should be between 12 and 18 inches. If a shiny object attached to a stick can be seen deeper than 18 inches (figure 3), apply fertilizer. If the shiny object disappears from view before it reaches 12 inches, the phytoplankton bloom is too heavy and fertilizer should not be added. This visibility method is based on the green color due to phytoplankton. It cannot be used when the pond is muddy or in ponds that have a dark stain because they are fed by blackwater streams.

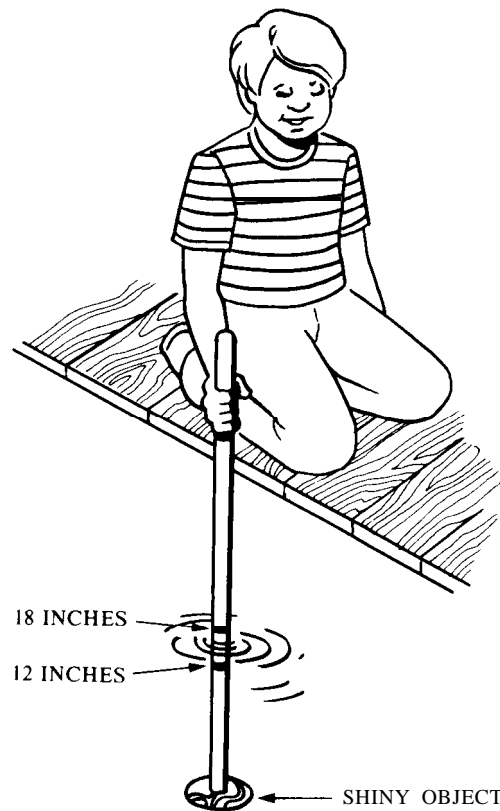


Figure 3. When the 18-inch mark is at the surface, the shiny object should be out of view. If it is still in view, increase the bloom by fertilization. If the shiny object is out of view when the 12-inch mark is at the surface, the bloom is too great. When this is the case, do not fertilize until bloom decreases.

Methods of Application

Spread liquid fertilizers over the entire pond surface. There are several formulations on the market. Some liquid fertilizers must be diluted prior to application, while others can be poured directly into the pond. The label will list specific procedures for application. Most liquid fertilizers are heavier than water and if they are applied at one spot, the nutrients tend to sink to the bottom and become bound in muds and sediment. When applying granular fertilizers, it is important to keep the granules from coming in direct contact with the mud. If granules are in contact with mud before they dissolve, a considerable amount of the phosphorus can become trapped in the mud and is unavailable to promote bloom development. The following application technique is recommended for granular fertilizer:

1. Slit one of the two flat sides of the bag in the form of a letter "H."
2. Peel the resulting flaps back.
3. Lay the bag in shallow water with the open side toward the surface.
4. Disperse bags as much as possible.
5. Follow label directions for the application of slow release pond fertilizer.

Is It Possible To Overfertilize?

Excessive fertilization can result in a fish kill. Phytoplankton produces oxygen in the daylight through photosynthesis. In the absence of sunlight this same phytoplankton consumes oxygen. In ponds with a heavy phytoplankton bloom, dissolved oxygen levels may be extremely high during the afternoon and drop to near zero just after sunrise. A properly fertilized pond should have visibility to at least 12 inches. If visibility (due to the bloom) is less than 12 inches, the phytoplankton is so abundant that on hot, cloudy days it may use more oxygen than it produces. This results in less dissolved oxygen available to fish. Reduce fertilization rates during very hot dry weather.

Liming

The addition of lime increases fish production in soft (low total hardness) waters. Many ponds in the southeastern United States have very soft water and will not develop satisfactory plankton blooms unless lime is periodically added. Agricultural (dolomitic) lime is the best choice for sportfishing ponds. Check ponds for lime deficiency every three to five years. Lime has several desirable effects on water quality. Addition of lime stabilizes the pH of bottom mud and increases the

availability of phosphorus. It increases the production of aquatic insects in muds, providing more food for small fishes. Liming increases the availability of carbon dioxide for photosynthesis. The overall effect of liming is to increase phytoplankton production which results in increased fish production.

Many ponds in Georgia have very soft water, with a total hardness less than 10 ppm (parts per million). Often, these ponds must be limed before a satisfactory bloom will develop. In ponds with a total hardness over 20 ppm, adding lime may have little effect on fish production. In ponds with a total hardness of 15 to 20 ppm, the increase in phytoplankton and fish production may be minimal.

It is necessary to measure total hardness (CaCO_3) to determine pond lime requirements. Alkalinity is actually a better indicator of lime requirements. However, in the southeastern United States most ponds have hardness and alkalinity values of similar magnitude (and hardness is much easier to measure). If total hardness is less than 10 ppm, the addition of at least one ton of agricultural lime per surface acre usually will bring total hardness to acceptable levels. For best results spread the lime over the entire pond rather than dumping it at one location. For larger ponds or ponds that have inaccessible banks, spread the lime from a boat. Specific lime requirements for particular ponds can be determined by county Extension agents, or Soil Conservation Service or Department of Natural Resources personnel.

Although lime can be applied at any time, it takes about two months for agricultural lime to go into solution. For best results, lime ponds in fall or winter. This will allow total hardness to reach appropriate levels by the time fertilization begins in the spring. In new ponds, lime can be spread prior to filling. Many times the need for lime is first recognized when the recommended fertilization program fails to result in a plankton bloom. The total hardness of the water can be temporarily raised by applying hydrated (builder's) lime. Although hydrated lime goes into solution quicker, the increased total hardness usually lasts only six to eight weeks. The recommended application rate is 50 pounds per surface acre, spread over the entire pond.

CAUTION: OVER APPLICATION OF HYDRATED LIME CAN KILL FISH.

Some Common Mistakes

1. Failure To Maintain Bloom Throughout the Season and From Year to Year

A haphazard fertilization program is worse than no fertilization at all. Fertilizing a pond once or twice a year results in sudden increases in the food supply, increases in the weight of fish in the pond, then a rapid decline in available food. This can lead to an unbalanced fish population. Failure to maintain the bloom can promote aquatic weed growth as nutrients are added and the water clears.

2. Beginning Fertilization Too Late in the Spring

If undesirable rooted aquatic vegetation becomes established prior to the initial fertilizer applications, the added nutrients may promote even more weed growth. Rooted aquatic vegetation that has reached the surface cannot be controlled with fertilizer. Treat exposed rooted aquatic vegetation with a herbicide prior to beginning fertilization.

3. Failure to Check Total Hardness (Lime Requirements)

Check total hardness of fertilized ponds every three to five years. If you have eliminated other possible reasons for lack of bloom development, your pond probably needs liming.



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