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The Use of Lime in Fish Ponds[1]

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Liming is a common practice in the southeastern United States. There are three main purposes for liming ponds: 1) to increase the availability of nutrients, 2) to increase pH and to buffer against daily pH fluctuations. and 3) to sterilize ponds prior to stocking. While these practices use lime, they involve different compounds.

Liming to Increase Nutrient Availability and to Increase and Buffer pH

The application of limestone (calcite or dolomite) to fish ponds with acid soils will increase the availability of nutrients, primarily phosphorous, to aquatic plants, specifically phytoplankton. Phytoplankton (microscopic free-floating plants) are the base of the food chain in fish ponds, and are essential for rapid fish growth and survival in recreational fish ponds and in commercial ponds in which small fish are being reared. Calcite and dolomite increase the total hardness, total alkalinity, pH, and act as a buffer to keep the pH constant. The rise in pH is primarily responsible for increasing the availability of phosphorous from the pond muds. Although pH can range from 1 to 14, pH of 6 to 9 is considered desirable for most freshwater fish. Water in ponds reflects the quality of the soils thev are in. In acid soils. ponds typically have low alkalinit,'. hardness and pH. Hardness and alkalinity values of less than 20 parts per million (ppm) and a pH value of 6 or less, are common in many ponds in the southeastern United States. Fish production in these waters is poor. Calcite (calcium carbonate) and dolomite (a combination of calcium and magnesium carbonates) both increase the hardness (the calcium and magnesium concentration) of water.

Carbon dioxide, a by-product of respiration of plants and animals, acts as an acid in water, reducing the pH, especially at night. Plants photosynthesize during the day, consuming carbon dioxide, which causes pH to increase. This daily fluctuation in pH is greatest when alkalinity is low. At higher alkalinity. more carbonates are present to bind with the free carbon dioxide in what is termed the carbonate cycle. The addition of lime to a pond increases its alkalinity (carbonate concentration) which decreases the amount of free carbon dioxide in the water, and therefore increases and buffers the pH.

Phosphorous is almost always the limiting nutrient in freshwater ponds, and is relatively unavailable when pond soils have low pH values. The increased pH resulting from liming improves the availability of phosphorous, making fertilization more effective. In addition. microbial activitv is increased at higher pH, which will assist in decreasing the amount of organic debris at the bottom of the pond.

Identifying Liming Needs

Identifying liming needs can be accomplished by taking either a water or soil sample from the pond. Measuring the total alkalinity of water in the pond is the most effective, and easiest way to determine if liming is necessary. Local county

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extension offices are often equipped to measure the total alkalinity of a water sample or can assist you with purchasing a test kit of your own, or in sending a water sample to a lab for analysis. Liming is recommended for ponds with a total alkalinity of less than 20 ppm.

Certain fish species require hardness levels above 50 ppm for good health. For example hybrid striped bass require hardness levels above 100 ppm, and a minimum hardness of 200 ppm is required for production of redfish. Liming can also be used to increase the hardness of water by the addition of calcium and magnesium.

Common application rates for limestone are 1 to 2 tons per surface acre. However, a more accurate rate can be calculated by taking a soil sample from the pond bottom and having a laboratory make a recommendation. Collection of soil samples is easiest before ponds are filled, but can be taken in a pond with water. Pond soil samples can be taken from a boat by using a can attached to a long pole. Samples should be collected from the top 6 inches of soil, from numerous locations in the pond. It is recommended that 12 samples be taken from ponds up to 2 acres, and 25 samples be taken from larger ponds. These samples are then thoroughly mixed dried, and at least one pint of soil is sent to the laboratory. Check with your county extension office for information on laboratories.

Selecting Material

Limestone is readily available in the southeastern United States in varying grades and quantities. Small bags are available through most garden centers for small pond owners and for larger ponds, limestone can be delivered to the pond site by the truck load.

Reaction time and solubility of limestone are directly related to the particle size. It is recommended that you purchase the smallest particle size available for use in the ponds.

Timing of Application

Limestone can be added anytime during the production cycle. However it is recommended that application be made during the fall and winter months when fertilizers are no longer being added to the pond. Limestone will take several weeks to complete its impact on the water quality, so application should be at least one month prior to the initiation of a fertilization program in the spring.

Method of Application

Limestone is best applied directly to the pond bottom prior to filling the pond with water. It should be spread evenly over the entire bottom. For large ponds a lime spreading vehicle will make the job easier. A disk harrow can be used to further incorporate the lime into the soil. Applying limestone to ponds which are full of water is more difficult, but can be done without fear of harming the fish. The material should be broadcast evenly over the entire pond surface. For large ponds, a small boat with a plywood platform can be used to carry the lime beyond the reach of shoreline broadcasting; care must be taken to not overload the boat, as a small volume of limestone is extremely heavy (Figure 1). There are commercial pond management companies, which can be hired, who have barges specifically designed to lime ponds. Dumping limestone in large piles on the edge of the pond is extremely inefficient and not recommended. For extremely small ponds or tanks, limestone can be dissolved in a bucket of water, and then added to the pond or tank.

Figure 1. Applying lime to a pond from a boat can be effective, but care must be taken not to overload the boat.

Liming Frequency

The effects of adequate liming will usually last several years in ponds with little or no outflow. Ponds, which frequently discharge water, may have to be limed annually. Total alkalinity and pH should be monitored to determine the necessary frequency of liming.

Liming to Sterilize

Hydrated lime. or calcium hydroxide, is also used in fish ponds. While it will increase hardness (the calcium component), and temporarily increase the total alkalinity (the hydroxide component), its primary effect is to raise the pH of mud and water quickly and dramatically.

Ponds should be drained and cleaned prior to applying this product. Enough hydrated lime should be added to cover the entire bottom with a thin layer, and then water added. The pH in the upper layer of the mud and in the water will rapidly rise to 12 or higher, a level which will kill most disease agents and/or pests. The elevated pH will last for about a week, prohibiting any stocking of fish. Always check the pH before stocking.

Adding hydrated lime is not recommended when fish are present in the pond. The sudden increase in pH is often lethal.

The use of hydrated lime is recommended when there is any concern of carrying diseases or pests over to the next crop. It has limited, long-term impact on total alkalinity and pH.

Hydrated lime is considered to be a strong base, and care should be taken when applying. Avoid breathing the dust and do not allow it to contact skin or eyes.

Summary

Liming is an effective tool in fish production and pond management. However, lime is casually used to describe two different types of materials, used for very different purposes.

Agricultural limestone refers to calcite (calcium carbonate) and dolomite (calcium magnesium carbonate). The calcium and magnesium components raise the hardness of water, essential to the health of many aquatic species. The carbonate component raises the alkalinity and the pH. Buffering daily fluctuations in pH, increasing microbial activity in the pond soil, and increasing the availability of phosphorous to phytoplankton. Pond water with total alkalinity less than 20 ppm can benefit from liming.

Hydrated lime (calcium hydroxide) is an inexpensive and effective pond sterilizer, raising the pH quickly and dramatically above tolerable levels for most aquatic organisms. It should be used carefully, avoiding contact to the applicator, and never used in ponds containing desirable fish.