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Ponds built in areas that have acid soils and soft water may not always perform well for fish production. Such ponds may benefit from liming if the water has a total alkalinity of less than 20 mg/l (20 ppm). If alkalinity is more than 20 mg/l, liming may not be beneficial. Alkalinity measures the buffering capacity of the water and is usually a good indicator of productivity. Carbonates, bicarbonates, hydroxides, phosphates, and organic substances are the main components of water alkalinity. Water hardness is caused by calcium, magnesium, iron, and aluminum salts, most often in the form of carbonates, sulfates, or chlorides. Ponds that have water hardness concentrations of less than 20 mg/l may also benefit from liming. Alkalinity and hardness can be measured with commercially available water test kits, or by State Fisheries or Extension Service Aquaculture Specialists. Generally, total alkalinities of 100–120 mg/l, water hardness concentrations of 100–250 mg/l, and pH values between 6.5–9.0 are considered desirable for freshwater fish production.

Liming a pond properly will raise the pH of bottom muds and water, and make phosphorus more available for plant production. Low levels of phosphorus may limit the growth of a pond's microscopic plants, which are the foundation of the aquatic food chain and pond productivity. Fish populations should benefit from liming. Liming can enhance nutrient cycling; the breakdown of organic matter, and may also help clear muddy pond water.

Liming may be less effective if the pond has a large watershed and water is exchanged more than once every 3 or 4 weeks. Surface coal mining spoils contain pyrites, which can produce sulfuric acid when exposed and weathered. Ponds should not be constructed on these watersheds unless the soil has been tested or the acidic runoff water can be diverted away from the pond. Ponds should be limed during the late fall or winter, especially if a pond fertilization program is begun the following spring. If low alkalinity ponds are fertilized before being limed, much of the phosphorus may be lost to the bottom muds. Therefore, the effort and expense of fertilization could be wasted. However, lime should not be added to a pond which has been recently fertilized as it tends to remove phosphorus from the water.

Ponds can be limed with liquid lime, basic slag, or agricultural limestone. The acid neutralizing value represents the ability of a liming material to neutralize acid when compared with pure calcium carbonate (which represents 100%). Liquid lime works rapidly but contains 50% water, which doubles the amount of material to apply. Basic slag has a neutralizing value of 50–79%. The values for agricultural limestone range from 95–108%. Hydrated or slaked lime has a value of 136%, and calcium oxide has a value of 179% and should not be used to lime fish ponds. Calcium oxide or hydrated (slaked) lime will not increase carbonate alkalinity and could drastically raise water pH, which may kill fish. Agricultural limestone is usually the best choice. It is inexpensive ($9.00–$22.00/ton) and safe to use in fish ponds. Agricultural limestone should be ground fine enough to pass through a 10 mesh sieve. Small particles will dissolve more readily in water. A sieve analysis may be required to determine particle size and assign the lime an efficiency rating.

The amount of lime required per surface acre of pond is determined by analyzing pond mud samples. Samples should be taken randomly from deep and shallow areas, making an "S"-shaped pattern over the entire length and width of the pond. Mud samples can be collected from existing ponds using a boat and an 8-oz can attached to a long pole or by taking small plugs of mud with a length of PVC pipe. In ponds greater than 5 surface acres, three to six similar sized mud samples should be taken per acre. Smaller ponds require 10–15 mud samples per surface acre. The samples should be mixed together and allowed to air dry on a flat surface. Pond mud samples should then be pulverized and placed in a soil sample box marked "fish pond." These samples can then be submitted to a private soils testing lab or to your county extension office to be sent out for processing (for a small fee).

Lime application rates will usually be made on the basis of 1,000–10,000 lb/surface acre. The equation used is similar to the following:

$$\text{Application rate} = \frac{\text{Liming Rate}}{\dfrac{\text{Neutralizing Value}}{100} \times \dfrac{\text{Efficiency Rating}}{100}}$$

Lime should be distributed as evenly as possible over the entire surface of a full or dry pond. The best time to lime a pond is before filling, lime can be applied with a spreader and mixed into the pond bottom with a disc-harrow. Small, full ponds can be limed by spreading bagged lime from a boat or by broadcasting it from the shore. Large ponds may require greater amounts of lime, which is more economical when purchased in bulk quantities. Lime can be loaded onto a ½-inch plywood platform placed over the bow of a large boat or between two small boats. The material can be shoveled or washed off the platform using a water pump, while moving slowly across the pond. A boat 18 feet long by 6 feet wide can carry 1,500 lb of agricultural limestone.

Ponds may need to be limed every 3–5 years. A good general rule for liming ponds is to apply lime at rates similar to those used for alfalfa field preparation. To maintain a pond's pH and alkalinity at desirable levels, the lime should be applied annually by adding one-fourth of the initial application. Pond alkalinity and pH should be checked each year to evaluate the effectiveness of supplemental liming. Total alkalinity should not be less than 20 mg/l with pH values between 6.5–9.0.

Considering the relatively low cost involved in the maintenance of a pond's lime requirement, ponds should be limed before implementing a pond fertilization program. If liming does not improve fish production to a satisfactory level after 1 year, a fertilization program should then be tried.

Adding agricultural gypsum to ponds can percipitate available phosphates, which can reduce dense algae blooms, increase water hardness, and may reduce turbidity. The pH of pond waters (generally with a pH ≥ 9.5) that have high alkalinity and comparatively low calcium hardness may be reduced by the addition of gypsum (calcium sulfate) or land plaster. High water alkalinity and low calcium hardness often occur where bicarbonate and carbonate ions are associated with the more soluble sodium, potassium, and magnesium elements, as opposed to calcium. When plants remove carbon dioxide from the water during photosynthesis, carbonate ion concentrations increase. In the presence of the less soluble calcium, the hydrolysis of carbonate to hydroxyl ions elevates the afternoon water pH to approximately 9.5 or 10.0. At this point, calcium carbonate begins to percipitate. Since the hydrolysis of carbonate and the formation of hydroxides that elevate pH have been limited by carbonate percipitation, pH will not increase further. However, where alkalinity is high and calcium concentrations are low, afternoon pH may rise above 10 and become toxic to some aquatic organisms.

According to Auburn University researchers, agricultural gypsum may cost approximately $200.00 per ton. The rate of application in mg/l can be calculated by the following equation:

$$\text{Application rate of agricultural gypsum (mg/L)} = \text{total alkalinity (mg/L)} - \text{total hardness (mg/L)} \times 4$$