Lime Application For Improved Fish Production

Some ponds have naturally low fish production. Water is characteristically clear and aquatic plant growth is sparse. The pond owner may have applied fertilizers to the pond in an attempt to produce a phytoplankton bloom, without success. Watershed soils may consist mostly of clays, granites, shale, sand, peat or other materials that may be acidic or low or lacking in calcium carbonate. Ponds with these characteristics may benefit from lime applications.

Benefits

Liming benefits the pond by providing calcium necessary for shell growth in snails and molluscs, exoskeleton production in insects and crayfish and bone and scale production in fish. Some of the carbonate supplied by lime is converted to CO_2 and used in photosynthesis. Much of the carbonate is stored in the pond bottom and released into the water column as pH values decline, acting as a buffer to prevent wide swings in pH. At pH levels above 8.3, calcium carbonate precipitates out of the water and settles to the pond bottom. By maintaining pond pH at neutral to slightly alkaline levels, phosphorous is released from bottom sediments and made available to nourish phytoplankton that make up the base of the food chain. Also, wide swings in pH can stress aquatic animals. Stress slows growth and makes plants and animals more vulnerable to disease. At pH levels below about 5.5 fish stop reproducing. Below pH 4 fish begin to die. Fish may also die at pH levels above about 10 -11.

Water testing

Test pond water alkalinity to determine need for lime. Pond productivity usually can be improved by lime application where alkalinity levels are below 20mg/l. Liming usually is not beneficial at alkalinity levels above 50 mg/l, or at pH levels above 8.3. Alkalinity is a measure, primarily of the amount of carbonate and bicarbonate ions in the water. Although it is called alkalinity it does not relate back to the same term used in connection with pH. The identical terms often cause confusion. See sec. On water quality for a full explanation of alkalinity and hardness. Consult a county extension agent or state fisheries specialist for water quality testing availability .

Test pond water hardness to determine levels of calcium and magnesium in the water. The hardness test also measures other minerals but these two are the most common and most important to aquatic life. Liming increases hardness to levels suitable for most fish production.

Application rate

In most ponds less than about 1 surface acre, lime can be applied at a rate of 2 tons per surface acre with good results. It may be more economical in larger ponds to sample pond bottom soil to get a precise application rate. It is practically impossible to apply too much ag lime to a pond.

Sampling pond soil

To determine the amount of lime required for a pond, soil samples must be taken from the pond bottom. Samples can be sent to an agricultural soil testing lab

for analysis. Labs may not have a test specifically for ponds, however, 2 times the level recommended for row crop production in the local area will satisfy the lime requirement for ponds.

It is most convenient to take soil samples before the pond is filled with water, however, this is not usually possible.

Take at least 10 soil samples per surface acre of pond. Collect samples from the first 6 inches of soil. A can attached to a long pole can be used to scoop mud from the pond bottom in ponds already filled with water. Collect samples from as many areas of the pond as is practical. (See figure). Combine soil samples and spread the mixture out to dry. When the soil sample is dry, pulverize the clods and thoroughly mix soil. About 1 pint of the mixture is needed for the soil analysis.

Lime products

Lime is available in several forms. It is not advisable to use some of these products in the pond. Quick lime (CaO) and slaked lime ($Ca(OH)_2$) rapidly raise pond pH and kill fish and other aquatic organisms. Liquid lime, a mixture of very finely ground agricultural limestone and water is suitable from a biological stand point and is easy to apply, however it is expensive and twice as much of this product is required compared with most ground agricultural limestone. Liquid lime is a convenient product to use in garden ponds and other lower volume applications. The best choice for most pond applications is agricultural limestone. This material can be purchased in 40 lb bags or by the truckload. Agricultural lime is very safe for pond use. Cost is about $10-50/ton depending on purity, fineness of the ground material; and whether it is bagged or purchased by the truck load in bulk.

Calculating application rate

Laboratory test results will indicate the amount of lime needed for the pond. The amount needed will be reported as the **neutralizing value** (NV) of pure calcium carbonate. Typically, agricultural lime has a neutralizing value that is 85% - 109% that of pure calcium carbonate. The NV depends on chemical composition and impurities, clay etc., found in the product.

Neutralizing efficiency depends on the fineness of the agricultural lime particles and is given as a percent. The finer the limestone is ground the more easily it dissolves in water. The neutralizing value and or the neutralizing efficiency rating should be available for the agricultural lime purchased. Either of these values can be used to calculate the amount of agricultural lime to apply to the pond. If NE and NV are available, Convert the percentage values to decimals and multiply NE x NV ; then divide the resulting number into the liming recommendation in tons / acre.

Example: NV = 85% NE = 75% liming recommendation = 3 tons/acre.
.85 x .75 = 0.6375
3 tons/ acre ÷ 0.6375 = 4.7 tons/acre ag lime to be applied to the pond.

Often only the NE or the NV is available for the ag lime. If only one value is available divide the liming recommendation in tons / acre by the given value as a decimal.

Example: NV = 90% lime recommendation = 2 tons/acre
2 ton/acre ÷ 0.9 = 2.22 tons/acre agricultural lime applied to the pond.

Lime is best applied evenly over the pond bottom and this is easiest to do before the pond fills with water. In newly constructed or drained ponds, the lime can be applied with a tractor pulled lime spreader.

Lime can be spread in water filled ponds from a boat. A barge equipped with a pump and slurry box is most efficient for spreading lime over the pond surface and is the most suitable choice for treating large areas. For most applications a large flat bottom boat works suitably well. Attach a 4ft. X 8ft. Plywood sheet to the center of the boat, across the gunwales. Load ag lime onto the platform and with a shovel,

distribute the necessary amount of lime evenly over the pond. The lime can be dumped into the prop wash of a boat motor to help dissolve and distribute the material. This is a laborious method but is required to effectively lime the pond. Place and load the platform carefully to avoid overturning the boat.

Most of the ag lime will sink to the pond bottom. The water may appear “milky” for a few days then clear. Muddy ponds may clear as suspended clay particles causing the turbidity settle to the bottom; due to pH rise and electrical charge changes on clay particles brought about by lime application. Improved water clarity increases light penetration and phytoplankton production.

Liming raises pH immediately following application; most noticeably in acidic ponds. Agricultural lime will not raise pH high enough to kill fish. As pH rises, free CO_2 will decline and alkalinity level (available carbonate and bicarbonate ions) will rise.

Lime application timing

Lime can be applied to the pond at any time of year. However, if the pond is to be fertilized, lime should be applied 1-2 months before the fertilizer application. This is necessary because lime combines with soluble phosphorous and becomes bound in bottom sediments. Phosphorous in pond sediment is released as pH rises to neutral and above and oxygen levels increase. The phosphorous is made available to pond organisms any time pond water mixes, usually during fall and winter overturns.

Test alkalinity, hardness and pH every 1-3 years to determine if additional lime application is necessary. Periodic lime application my be necessary if the pond is flushed by heavy runoff rainfall or acidic compounds enter the pond from the watershed.