Maryland Sea Grant Extension Program

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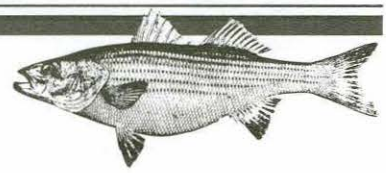

Liming Aquaculture and Farm Ponds in Maryland

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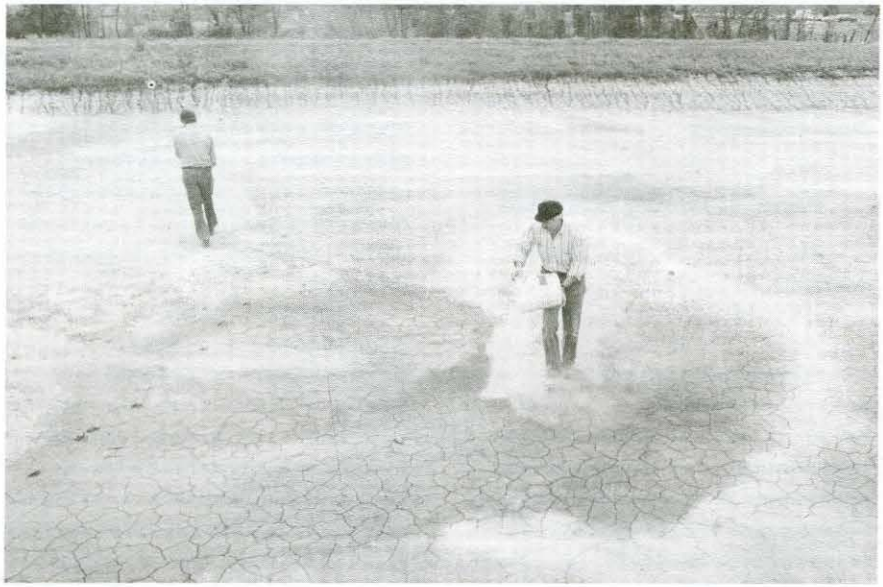

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Introduction

Farmers realize that to effectively grow crops they must periodically lime their fields to maintain the proper soil pH. If you plan on growing fish in a pond, you will probably have to do the same. Whether you use your pond for recreational fishing or for raising a commercial fish crop, having the right balance of lime is important.

Liming increases the effectiveness of fertilizers added to the pond by making more of the phosphorus available for plant use. Lime also increases the alkalinity of water which increases the availability of carbon dioxide for photosynthesis.

The increased availability of phosphorus and carbon dioxide will, in turn, increase populations of phytoplankton (microscopic plants) which will promote larger populations of zooplankton (microscopic animals). Both phytoplankton and zooplankton are important food for fish. The addition of lime helps guard against daily pH (acid level) fluctuations that are common in ponds with dense populations of aquatic plants; lime can also improve the effectiveness of many herbicides used to control aquatic weeds. In addition, liming may also prevent some fish from being killed by these herbicides, as some of these chemicals are more toxic in soft acidic waters.

When Does a Pond Need Lime?

Liming is necessary when pond water is acidic: generally this means that it has an inadequate amount of hardness or alkalinity. One indicator of low alkalinity is the inability of a pond to develop or maintain a proper phytoplank-ton bloom (the greenish color) after applying a fertilizer such as 20-20-5.

You can better determine the necessity for lime by using a simple water testing kit. These kits are available from fish farm supply stores and can test for pH and alkalinity. Alkalinity is measured in parts per million and pH in units from 1 to 14 (7.0 is neutral). In general, when pond

water is below a pH of 7 with an alkalinity value of 20 ppm or less, the pond needs to be limed.

Unfortunately, test kits cannot tell you how much lime to apply. You can determine this by taking mud samples from the bottom of the pond and having them chemically analyzed. The analysis can be done for a small fee by the University of Maryland Soil Testing laboratory. Soil sample packets are available at your local county extension office.

How to Take Samples for Determining Lime Requirements

Before a Pond Is Filled

You will want to make a composite sample by collecting a minimum of 10 or 12 soil samples from different areas of a 1 to 5 acre pond. (Collect proportionally more samples from larger ponds.) Smaller ponds should have at least 10 samples combined to make up the final composite sample. Mix all of the samples thoroughly in a clean container. Air dry the soil by spreading in a thin layer over a clean surface. After drying, pulverize the soil and place a representative sample in a soil sample bag. Be sure to write *Fishpond* on the soil sample information sheet. Send the sample with appropriate fee, to the Soil Testing Laboratory, H.J. Patterson Hall, University of Maryland, College Park, Maryland 20742. The liming recommendation will be returned to you and will be expressed as pounds per acre of Total Oxides (calcium oxide + magnesium oxide, or CaO + MgO).

After a Pond Is Filled

You will usually need a boat and a tool for scooping mud from the pond bottom. Such a tool can be made by attaching a tin can at a right angle to a wooden pole that is as long as the deepest part of the pond. You can then scoop mud samples.

Because lime requirements are usually lower in shallow areas of the pond compared with deeper areas the pond should be randomly sampled. By loosely following an S- or M-shaped pattern across the pond you should be able to mix enough mud samples to satisfactorily represent the pond bottom. You will need the same number of samples from a water-filled pond that you would from a dry pond. In both cases, the greater the number of individual samples that you combine to make your composite, the more likely it will be representative of the pond. Prepare the sample for mailing to the Soil Testing Service in the same way you would for samples from a dry pond.

Types of Liming Materials

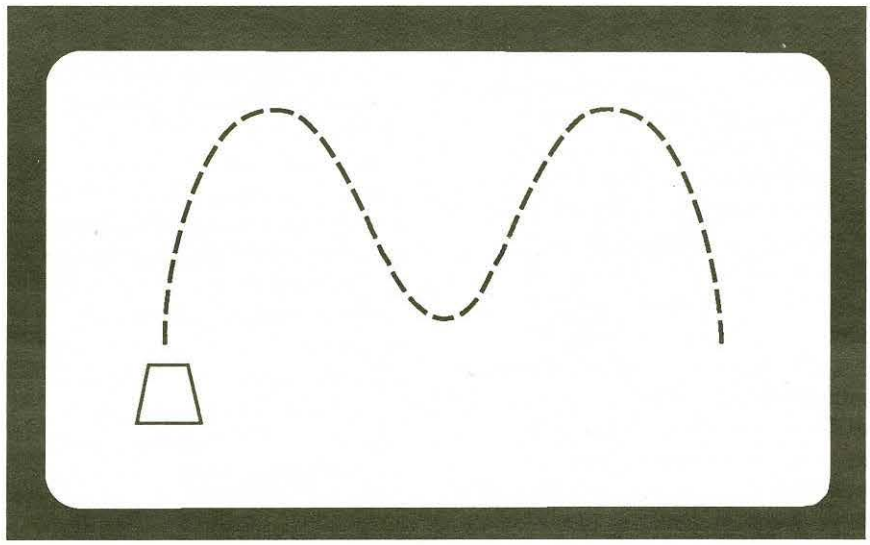
The kinds of liming materials available in Maryland which are best suited for fish ponds include ground limestone, hydrated lime, and some by-product liming materials. The most commonly available are ground limestone and hydrated or (slaked) lime. Liming materials that contain 6% or more of magnesium, which is equivalent to 10% or more of magnesium oxide (MgO), are called *dolomitic.* Liming materials with less than 10% MgO arc defined as *calcitic.*

Ground limestone consists of calcium carbonate, or calcium carbonate plus magnesium carbonate (CaC03 and MgCO,). The total oxide content varies from 37 to 56 percent.

Hydrated or slaked lime contains calcium hydroxide and perhaps magnesium hydroxide ($CaCO_3$ and $MgCO_3$). The total oxide content varies from 61 to 78 percent. It is normally quite finely divided and very reactive, and it does not have to be ground before use.

Liquid lime is a suspension of a very finely ground limestone in water. While it is an excellent material for correcting soil pH, it may contain only about a half ton of actual liming material per ton of liquid lime; thus the percent total oxides may only be about half that of ordinary ground limestone.

Finely ground agricultural limestone is normally the best material for treating fish ponds. Since hydrated lime is so reactive and more concentrated than most ground limestones, it may cause the water pH to go too high for a couple of weeks, which may result in a fish kill. If fish are not in the pond at the time of application, slaked or hydrated lime may be used



Take soil samples in an M-shaped pattern over entire length and width of pond.

so long as fish are not stocked until the pH returns to normal.

Calculating Liming Requirements

Because the objective in liming is to first correct the acidity of mud at the bottom of the pond, the amount of lime you will need to apply can be determined in the same manner as the lime application rate for a field crop, lawn or garden. To begin with, you will need to know the soil pH, soil texture and location of the pond. Your samples analyzed by the University of Maryland Soil Testing Laboratory will provide a pH value and soil texture. The geographic location simply means where in the state the pond is located: the coastal plain (Eastern Shore or Southern Maryland), the Piedmont Plateau (Central Maryland) or the Appalachian Mountain Region (Western Maryland).

In addition, the actual amount of lime your pond requires will also depend on the neutralizing value or reactivity of the agricultural limestone you apply. The important factors here are fineness of the ground limestone and total oxide content.

Total oxides include percent calcium oxide (%CaO) plus percent magnesium oxide (%MgO). Fineness of a good agricultural limestone is usually characterized as being ground fine enough so that at least 50% will pass through a 100 mesh screen and 100% will pass through a 20 mesh screen. Fineness does not apply to burned lime or hydrated lime. Any producer or distributor of liming materials in Maryland is required by law to provide the above information for ground limestone either on the bag or, if in bulk, on the invoice.

To calculate the pounds per acre of liming material needed, first determine the total oxide content (%CaO + %MgO) of the liming material to be used. For example, if you choose a liming material that contains 45% calcium oxide (CaO) and 5% magnesium oxide (MgO), then the total oxide is 45% + 5% or 50% total oxides. If the recommendation from the Soil Testing Service called for 1500 lbs/acre of total oxides, to find the pounds of liming material required, you would divide this requirement by 50 percent, or .50.*

Local county agricultural extension agents can offer assistance in developing the limestone application rate for your pond. They have tables or a computer program available that considers the above information and suggests the rate to apply.

How to Apply Lime

It is best to apply lime to a new pond before the pond is filled. The recommended amount and type of lime can be spread evenly over the entire pond bottom by use of a spreader or by hand. Never pile the lime in one area. It is advantageous to lightly disk the pond bottom to mix the lime into the pond soil: disking helps speed the action of lime in the soil.

Ponds already filled have to be limed by boat. If the pond is small, bagged lime can be easily spread over the entire length. If the pond is large, it may require several tons of limestone; in this case, you can place a sturdy platform across the beam of the boat and load limestone onto it. Be careful not to overload the boat as it can capsize — you may need to make several trips. Use a shovel to spread lime evenly over the pond. It is also possible to mix some types of lime into a slurry and pump it across the pond. Again, be sure to cover the entire surface.

It is not a good idea to spread lime along the water's edge by hand or spreader truck: since lime will not reach the entire pond bottom, the results are unpredictable.

When to Apply Lime

Even though liming can be done any time of the year, it is best done during late fall or early winter, after pond fertilization has stopped. Applying lime in the fall gives it time to react with the pond soil before spring fertilization is started. Generally, it takes three months for lime to react with the soil.

Never apply lime while a pond is being fertilized as the limestone settles the phosphorus out of the water and prevents its availability to the phytoplankton. By adding organic fertilizer to a new pond at the time of liming, water quality can be stabilized more quickly.

If you have not limed your pond and it is time to start fertilizing, hydrated lime can be added to temporarily meet a pond's lime requirements. In addition to the hydrated lime, add the recommended amount of agricultural lime immediately. A second application of fertilizer will be necessary six to eight weeks later, allowing time for the agricultural limestone to react with the pond bottom. Application rates of hydrated lime for this purpose should be between 50 and 100 pounds per surface acre. *Extreme caution should*

***Equation for determining liming materials requirements**

1500 lbs/acre + 50 = 3000 lbs/acre of liming materials containing 50% Total Oxides

be exercised when using hydrated lime as it can cause fish kills, and can be harmful to you if applied improperly.

How Often Should Lime Be Applied?

Provided there is no outflow of water from a pond, a lime application should improve the water quality for a long time. However, there are cases when periodic liming is necessary for a number of reasons: because of pond drainage or seepage, because of run-off entering and leaving a pond, or because a pond is fed continuously by springs. As a general rule, ponds that have a fertilization program, acid soils, and a moderate inflow and outflow of water require liming about once every three years.

An aggressive and successful practice is to lime at the full recommended rate as determined by soil analysis and then follow up with one-quarter of that amount on an annual basis. Using this latter technique, it is recommended that you recalculate a pond's lime requirements on a three to five year cycle. In ponds with excessive water flow such as from large underground springs or streams that have been dammed up, liming may not be practical and, at best, is usually uneconomical.

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