Pond Bottom Dryout, Liming

Part II. Limit Liming After Soil Testing

Pond bottom soil should be sampled from multiple areas and combined in a composite sample for testing. Tilling can help the soil dry more quickly.

Li Li, Ph.D.
College of Fisheries and Life Science
Shanghai Ocean University
Shanghai, China

Julio F. Queiroz
Embrapa Meio Ambiente
São Paulo, Brazil

Claude E. Boyd, Ph.D.
School of Fisheries, Aquaculture and Aquatic Sciences
Auburn University, Alabama 36849 USA
boydce1@auburn.edu

Summary:
The authors believe that dryout periods likely destroy most organisms in pond bottoms, and liming of the entire bottom area should be done only to neutralize soil acidity and increase pH for organic matter decomposition by soil microorganisms. Use of hydrated lime for disinfection should be reserved to particularly wet parts of pond bottoms. When applying liming materials, it is important to spread them uniformly over moist soil – typically within two days after ponds are drained to assure dissolution.

Agricultural limestone is made by crushing limestone rock into particles whose sizes can vary considerably among products from different vendors. A recent study revealed that when applied to acidic soil in equal amounts, the particle size of the limestone had a marked influence on the resulting change in soil pH (Table 1).

Particle sizes large enough to be retained on a U.S. standard sieve number 40 with 0.85-mm openings did not increase soil pH significantly above that of the unlimed soil. Particles small enough to pass a U.S. sieve number 60 with 0.25-mm openings were the most effective in increasing soil pH. There was no significant improvement in the ability to increase pH as particle size decreased below 0.25 mm.

Thus, pond managers should strive to source agricultural limestone in which nearly all particles will pass a 0.25-mm sieve. Burnt and hydrated lime usually are fine powders, and the fineness of the particles usually is not an issue.

Burnt, Hydrated Lime

Burnt lime and hydrated lime initially cause a large increase in soil pH, as shown in Figure 1. However, the pH quickly drops as the hydroxide component of hydrated lime reacts with carbon dioxide to form carbonate – the same base found in agricultural limestone. Notice that the pH of the pond soil treated with hydrated lime was about the same as the pH of the soil treated with agricultural limestone after about one week.

Because burnt and hydrated lime cause a large increase in pH, they often are used as soil disinfectants. It is thought that by raising the pH, unwanted organisms in the soil – including disease agents – can be killed. This belief is supported by data shown in Figure 2.

The respiration rate in soil treated

Table 1. Effects of particle size on effectiveness of agricultural limestone in reducing soil pH.

Treatment		Application Rate (kg/ha)	Soil pH
Control		0	5.41 ± 0.22a
Particles Passed Sieve No.	Particles Retained Sieve No.		
–	10	1,500	5.65 ± 0.28[a]
10	20	1,500	5.60 ± 0.08[a]
20	40	1,500	6.05 ± 0.05[a]
40	60	1,500	6.34 ± 0.18[b]
60	100	1,500	6.57 ± 0.15[c]
100	140	1,500	6.57 ± 0.07[c]
140	200	1,500	6.42 ± 0.07[c]
200	270	1,500	6.58 ± 0.19[c]
270	–	1,500	6.68 ± 0.13[c]

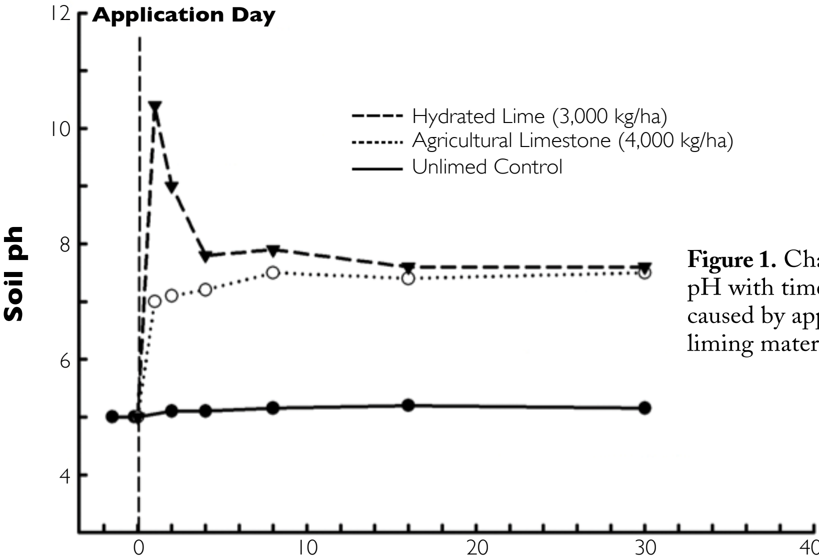

Figure 1. Changes in soil pH with time (in days) caused by application of liming materials.

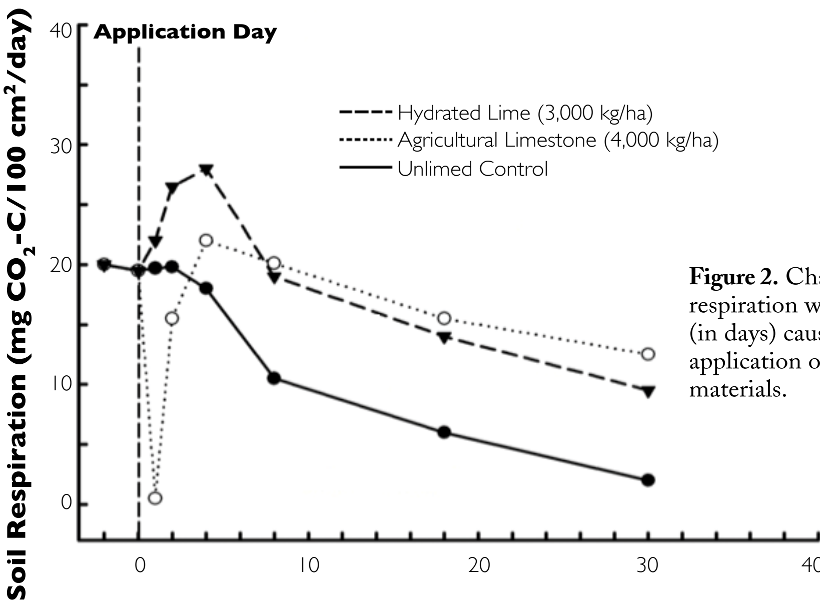

Figure 2. Changes in soil respiration with time (in days) caused by application of liming materials.

with hydrated lime fell to almost zero. But within two days after treatment, soil respiration was nearly as high as in the control. After four days, respiration in the soil treated with hydrated lime was similar to that of the soil treated with agricultural limestone.

This showed that the bacterial community in pond bottom soil can quickly recover from high pH.

Nevertheless, most disease organisms probably are killed by the high pH and would not be expected to re-establish like the saprophytic organisms do.

Another study found that 3,000 kg/ha and 4,500 kg/ha of hydrated lime were necessary to raise pH to 10 and maintain it at this level for one hour in an acidic soil with pH of 5.3 and alkaline soil with 7.6 pH, respectively. To maintain the soils above pH 10 for one day required 7,500 kg lime/ha in the acidic soil and 4,500 kg lime/ha in the alkaline soil.

Managing pH Above 10

The application rates required to increase soil pH above 10 are much greater than farmers tend to use. Moreover, the evidence that liming is highly effective as a pond soil disinfectant is not irrefutable.

The authors believe that dryout likely destroys most organisms in pond bottoms, and liming of the entire pond bottom should be done only to neutralize soil acidity and increase pH into the optimum range for organic matter decomposition by soil microorganisms. Use of hydrated lime for disinfection probably should be reserved to parts of pond bottoms that cannot be dried. It would be economically possible to apply 500-750 g/m^2 or greater amounts of lime over wet areas to cause a very high pH and provide more assurance of disinfection.

Uniform Application

When applying liming materials to ponds, it is important to spread them uniformly over the entire bottom or over the wet areas selected for treatment. If soil is completely dry when liming materials are applied, they will not react with soil acidity or dissolve to increase soil pH. Lime should be applied within two days after ponds are drained to assure dissolution. When soils are tilled, liming materials are incorporated into the soil mass.

Recommendations

The following practices are recommended for effective pond bottom dryout and liming:

- As soon as possible after draining a pond, obtain a composite soil sample by mixing samples of the upper 5-cm layer from eight to 12 places. Dry and pulverize the composite sample to obtain a pH measurement.
- Remove sediment from areas where it is too deep to dry properly.
- If soils are acidic, apply liming material uniformly over the entire bottom while soil is still moist.
- Till the soil, especially soil that does not dry easily.
- If there are wet areas that will not dry, treat them with large applications of burnt lime or hydrated lime.
- Dry pond bottoms for two to three weeks.