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Most Asked Agronomic Questions

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Chapter 1

Liming and pH

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1. How long does it take for lime to work?

The length of time that it takes for lime to neutralize soil acidity depends upon the type of lime used. Liming materials differ widely in their neutralizing powers due to variations in the percentage of calcium and/or magnesium and impurities (silt, clay, etc.) contained in the limestone. Refer to Table 14, page 18 of the *Ohio Agronomy Guide, 13th ed.* for a listing of the TNP (total neutralizing power) of various agricultural liming materials. Usually, liming materials with high TNPs tend to neutralize soil acidity faster than those with low TNP'S.

The coarseness of the liming material will also influence how fast the lime will react. The finer the liming material, the greater the surface area and the faster it will react with acid soil.

2. How little or how much lime can be applied at one time?

There is no lower limit to the amount of lime that can be applied at one time. You can apply as small a quantity of lime as the application equipment will allow. Typically, an applicator will not uniformly spread amounts less than 2 tons/acre. Likewise, there is no definite upper limit to the amount of lime that can be applied at one time. You must, however, be careful not to add such an excessive amount of lime that the soil pH rises above 8. For most Ohio soils, there will be a risk of over-liming if the application is in the range of 15-20 tons or more of agricultural ground lime/A.

3. When should lime be applied?

The answer to this question depends on the pH of the soil. When large additions of lime are needed to correct soil pH, lime should be applied as far preceding planting as is practical so that there is ample time for neutralization of soil acidity. Preferably, such an application would be made at least 3 months for row crops and 6 months for forage crops prior to seeding. When only a maintenance application is needed (2 tons or less per acre), lime should be applied before primary tillage so good incorporation is obtained.

Under no-till systems, autumn normally is the best time to apply lime. Application at this time tends to

minimize N losses.

4. Should lime be worked into the soil or placed on the surface? Will lime react with herbicides etc.?

Tillage should be used to work lime into the soil whenever possible. Good lime soil contact will help maximize the effectiveness of the liming material.

Surface applications of lime are not normally recommended. Surface applied lime moves into the soil profile at a very slow rate. In fact, in Ohio we have estimated that lime will move downward at a rate of approximately 1 inch per year. Even under no-till systems, it is best if the lime can be lightly incorporated with shallow tillage such as a disk. If, however, the slope of the field is steep enough to cause erosion, leave the lime on the no-till surface.

Lime does not typically react with herbicides; nevertheless, it may have an effect on the chemical activity of some herbicides. For example, soil pH levels less than 5.5 may reduce the activity of triazine herbicides (atrazine, Bladex, and Sencor), but soil pHs greater than 6.5 may tend to increase their activity and/or carryover potential.

5. What is the relation of tillage practices to lime?

As mentioned above, tillage allows for mechanical mixing of the lime with the soil. When reduced tillage systems are used, there will be a limited amount of mixing of lime and soil. In addition, surface applications of nitrogen fertilizers will tend to lower the pH in the top 1 inch of soil. Thus, no-till systems need to be closely monitored for pH changes. Soil samples should be taken more frequently when no-till is adopted. In general, more frequent lime additions are needed under no-till.

6. Acid subsoils are normal in our area. For corn and alfalfa, what are the subsoil pH levels that are troublesome? If adjustments to subsoil pH are needed, is there any practical, effective technique to raise the pH other than maintaining a plow layer pH at or near 7.0 and waiting years? How can we speed the increase?

If pH levels in the subsoil are below 5.5 for corn or below 6.0 for alfalfa, corrective applications of lime are needed. The pH level in the topsoil should be raised to pH 6.5 for corn or 7.0 for alfalfa and maintained at this level. As water flows through the soil profile, the added lime will be carried into the subsoil and gradually increase the subsoil pH. This downward movement will take years. There is no practical method to speed up this process except incorporating lime directly with tillage or by injection.

7. Types of lime and carriers such as Mg and Ca. When to use what?

On a soil that has a Mg content between 10% and 50% of the CEC, the lime carrier is usually not important. You can use either a calcitic or dolomitic lime. If the Mg level is below 10%, you should use a dolomitic carrier. This becomes particularly important if you are growing a grass crop for forage because the use of dolomitic lime should raise Mg levels in the grass and help to prevent grass tetany.

8. How does agricultural slag compare with lime as a neutralizing material? Is ag slag as good a liming material as ag ground?

Agricultural slag is a generalized term for fused calcium magnesium silicates. This material is normally a by-product of the steel industry. Generally, agricultural slag has less neutralizing power/ton of lime than does agricultural ground limestone; thus, higher rates of agricultural slag are typically required. When used at the appropriate rate, agricultural slag can be an effective liming material. One should, however,

be aware of the total composition of the agricultural slag that is used. Some materials that are sold as agricultural slag may have high levels of heavy metals, water and be course, thus slowing the soil reaction.

9. What are the advantages and disadvantages of liquid lime verses dry lime?

Liquid lime is approximately 50% $CaCO_3$ and 50% H_2O. It has the advantage of providing better uniformity of spread over the field in comparison to dry lime.

There are 3 main disadvantages of liquid lime. First, there are normally higher operational costs since you must haul both water and lime across the field. Secondly, more frequent lime applications are often needed since liquid lime reacts quicker than does a dry lime. Finally, over-liming is more likely to occur with liquid lime. You must be very careful of the rate at which it is applied. Because it has such a fast reaction time, you may run the risk of increasing the pH too high and thus accelerating denitrification or surface volatilization of urea, especially under no-till systems. As mentioned earlier, over liming will also tend to increase the activity of triazine herbicides.

10. The cost effectiveness of liquid lime products versus agricultural lime.

To make a decision about the cost effectiveness of these two products, one must compare both the total neutralizing power/unit weight of each and the cost/unit weight of each.

11. Why is there such a spread between LTI and pH?

PH is an unbuffered measure of the hydrogen ion concentration in the soil whereas LTI (lime test index) is a buffered measurement of total soil acidity. Soils with low buffering capacities (low C.E.C.) there can be a large spread between LTI and pH. At high pH's (>6.2), LTI is not very reliable for many soils.

12. A testing laboratory in our area often recommends liming soils above pH 7.0, claiming improved nutrient availability will result. Is there any merit to this?

Soil pH has a large influence on the availability of plant nutrients. Figure 7-1 and 7-2 on page 21 of the *Ohio Agronomy Guide, 13th ed.*, shows the relative availability of twelve essential plant elements at different pH values for mineral soils. Notice that at the pH range between 6 and 7 most of the essential elements are readily available. This is the reason that we recommend liming to this pH range.

Adding additional lime to raise the pH above 7 may give increased availability of molybdenum, but deficiencies in this micronutrient are rarely reported in Ohio. Thus, in practical terms, liming to pHs above 7 will not lead to improved crop nutrition.

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