



# Facts About Soil Acidity and Lime

## Questions and Answers

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### 1. What is lime?

According to chemical definition, lime is calcium oxide (CaO). In agriculture, lime is usually defined as calcium or calcium-magnesium containing compounds capable of reducing harmful effects of an acid soil by neutralizing soil acidity and raising the soil pH.

### 2. What is soil acidity?

Soils are acid because of hydrogen ions dissolved in soil solution (water in the soil) and held on the clay and humus particles. pH is a measure of the degree of acidity or alkalinity. A value below 7.0 is acid, 7.0 is neutral and above 7.0 is alkaline. As the soil pH decreases below 7.0, soils become more and more acidic.

### 3. What is active soil acidity?

Active soil acidity is the hydrogen that is dissolved in soil solution. Active soil acidity is determined in a soil pH measurement. It serves as a guide as to when to apply lime.

### 4. What is reserve acidity?

Reserve acidity is the acidity that is adsorbed on the surfaces of soil and organic matter particles. This portion of the soil acidity accounts for more than 99 percent of the total acidity. An accurate determination of lime need requires measuring this reserve acidity. Soil test labs use a special buffer pH method to determine the reserve acidity and lime requirement.

### 5. What is meant by neutralizing value (NV)?

Not all liming materials react the same on a pound-for-pound basis. Thus, it becomes necessary to establish a standard to evaluate the ability of liming materials to neutralize soil acidity. Pure calcium carbonate has a value of 100, and all other materials are chemically compared to this standard. Most liming materials contain impurities, so lime recommendations are made on the basis of a neutralizing value of 90 percent. If a liming material has an NV other than 90 percent, an adjustment will need to be made in the amount of lime to apply.

### 6. What is calcium carbonate equivalent?

Calcium carbonate equivalent (CCE) refers to the equivalent amount (pounds) of pure calcium carbonate in a ton or cubic yard of lime material. If a lime material has a NV of 85, it will have a CCE of 1,700 lbs per ton. If a source of marl has a calcium carbonate equivalent of 1,200 pounds, this means one cubic yard is as effective as 1,200 pounds of pure calcium carbonate.

### 7. What are the neutralizing values for commonly used liming materials?

Calcic limestone (agricultural grade) . . . . .	70–95
Dolomitic limestone (agricultural grade) . . . . .	95–108
Calcic hydrated limestone . . . . .	less than 135
Dolomitic hydrated limestone . . . . .	less than 170
Marl . . . . .	60–95

### 8. Is particle size of lime important?

Nearly all of the lime should pass through an 8-mesh sieve and 50 percent should pass through a 60-mesh sieve. An 8-mesh sieve has openings approximately 1/8-inch in size. Lime particles that are finer than 60 mesh react more quickly than coarser particles (between 8 and 60 mesh). The coarser lime particles provide residual neutralizing power.

### 9. Where can I get lime analyzed?

Most soil-testing labs will analyze lime to determine its neutralizing value and particle size distribution.

### 10. What is calcic limestone?

Calcic limestone is a naturally occurring rock composed primarily of calcium carbonate. It is sometimes referred to as high calcium or calcitic limestone. It usually contains less than 5 percent magnesium carbonate and 90 to 95 percent calcium carbonate.

### 11. What is marl?

Marl is a soft calcitic material, which has settled out of water over long periods. Fine textured, it consists of calcium carbonate, clay and organic matter.

### 12. What is dolomitic limestone?

Dolomitic limestone is a naturally occurring rock composed primarily of calcium-magnesium carbonate ( $\text{CaCO}_3 \cdot \text{MgCO}_3$ ).

### 13. How much magnesium does dolomitic limestone contain?

Dolomitic limestone being marketed in Michigan contains 15 to 45 percent magnesium carbonate by weight, the remaining 85 to 55 percent being largely calcium carbonate by weight. To determine the exact answer, an analysis of the material is required. The limestone analysis report usually expresses magnesium as percent magnesium carbonate. To convert to the elemental form, multiply the percent magnesium carbonate by 0.29. For example, a dolomitic limestone having 30 percent magnesium carbonate contains 174 pounds of elemental magnesium per ton (0.30 times 2,000 times 0.29). (Multiply by 2,000 to convert tons to pounds.)

### 14. When should I use dolomitic lime?

Use dolomitic lime when the soil test indicates the magnesium level is low to marginal. When the soil magnesium level is adequate, use either calcitic or dolomitic lime. There is no evidence that dolomitic lime has any harmful effects.

### 15. What is pelletized lime?

Pelletized lime consists of very fine calcitic or dolomitic limestone formed into pellets with a soluble binding agent. There is nothing special about the effectiveness of pelletized lime. It is chemically the same as traditional agricultural lime and neutralizes soil acidity the same way. Therefore, the rate needs to be the same as for agricultural lime to achieve the same effect.

### 16. What are the materials called fluid lime, liquid lime or lime suspension?

Finely ground limestone is suspended in water or a fertilizer nitrogen solution. The suspension usually contains 55 to 70 percent fine limestone (finer than 100 mesh), 25 to 40 percent water and 1 to 4 percent colloidal clay.

### 17. Are liquid lime materials better than dry lime?

Yes and no. These liming materials react quickly and bring about rapid increase in soil pH, but have limited residual effect for maintaining soil pH. One drawback may be that the total amount of lime that can be applied is usually less than with dry limestone. Thus, more frequent lime applications are needed. These materials also tend to be more expensive than dry agricultural lime.

### 18. Are wood ashes good for liming?

Yes. Check the soil pH first. If the soil pH is 6.5 or above, don't apply wood ashes. When lime is required, apply up to double the lime requirement every three years. For example, if the lime requirement is 3 tons/acre, limit the application of wood ashes to six tons in a three-year period. (On a garden, this would be 275 pounds of ashes per 1,000 square feet.) Check the pH before you apply more.

### 19. What are the benefits of using lime?

Liming acid soils results in better crop yields by: a) raising soil pH, b) improving overall nutrient availability, c) reducing soluble aluminum and d) improving microbial activity. When available in excess, aluminum and manganese are harmful to plants, inhibiting cell division in plant roots and reducing growth. Plants with aluminum toxicity may also experience calcium or magnesium deficiencies. Maintaining proper soil pH maximizes the availability of several plant nutrients. Proper liming increases the efficiency of applied fertilizer.

### 20. Will liming pay?

Yes. Where needed, lime will return \$5 to \$10 for each dollar invested in lime. Raising the soil pH from 5.7 to 6.5 in mineral soils may improve corn or soybean yields by 20 percent or more, and alfalfa yield by 35 percent or more.

### 21. How much lime should I apply?

Use a soil test to determine the amount of lime needed. A soil pH measurement alone is not sufficient to determine lime requirement. Most soil-testing laboratories use a special buffer pH method to determine the amount of lime needed. Michigan State University uses the SMP buffer method.

### 22. How long will it take for lime to react with the soil and how long will it last?

Lime will react completely with the soil in two to three years after it has been applied; although, benefits from lime may occur within the first few months after application. How long the effects of lime last will depend on the kind of lime used, total soil acidity, amount of organic matter, kind and amount of clay, and cropping and management systems used. A soil test three to four years after lime application will help provide the answer.

### 23. What if my leased land needs lime?

Farmers tend to be hesitant about applying lime to land that they may or may not have for crop production the next year. Farmers need to recognize the benefit they can receive in crop production during the application year, and landowners need to recognize that lime maintains the quality of their land. When lime is needed on rented land, a farmer needs to seek a multiple-year lease to guarantee the return on his or her investment or ask the landowner to share the cost of the lime, prorated over a four-year period.

### 24. Should I lime my soil to pH 6.0, 6.5 or 6.8?

For most crops, liming to pH 6.5 is recommended. When alfalfa is grown, liming to pH 6.8 is essential. For gardens, potatoes or low-maintenance grass pasture, liming to pH 6.0 will be satisfactory. Some crops, such as blueberries, that grow well under acid soil conditions do not usually benefit from liming. When several different crops are grown in rotation, lime for the most pH sensitive crop.

### 25. Will fertilizer replace the need for lime?

No. When soil pH falls below 5.5, the concentrations of soluble aluminum and manganese increase greatly. Under very acid conditions, plants accumulate toxic amounts of these two elements. Since many fertilizers are acid forming, regular liming reduces the hazard of creating an acid subsoil, increases the efficiency of fertilizer used and gives greater crop yield.

### 26. Should I topdress lime on my established lawn?

Check the pH of the zero- to 3-inch soil depth and if it is below 5.5, topdress at a rate of 25 to 50 pounds of lime per 1,000 square feet. When establishing a lawn, test the soil and apply the recommended rate and mix it with the soil.

### 27. Is there additional information available?

Yes. The following bulletins are available from the Michigan State University Extension Bookstore, 117 Central Services, East Lansing, Michigan 48824.

**E-471 - Lime for Michigan Soils**

**E-498 - Sampling Soils for Fertilizer & Lime Recommendations**

**E-2904 - Nutrient Recommendations for Field Crops in Michigan**

**E-2934 - Nutrient Recommendations for Vegetable Crops in Michigan**

They are available online at **[bookstore.msue.msu.edu](http://bookstore.msue.msu.edu)**.