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JOHN'S CORNER

Soil Amendments - Limestone and Dolomite

By John Ferguson

The past few weeks we have been discussing soil amendments of volcanic origins. This week I want to talk about soil amendments from sedimentary deposits. I often get asked how much lime should I apply to my soil? What the person is really asking is; how much calcium do I need? Many people use the term "Lime" in a generic sense for all products that contain calcium (Ca). Often the terms Lime, Limestone, Dolomite, etc. are mis-used and the person purchases the wrong product and gets disastrous results so I want to start with some definitions.

Lime - It is also referred to as Quicklime and is calcium oxide (CaO). It is sometimes found naturally in nature, where coal seams have burned or near volcanoes where there are limestone deposits that have been exposed to the high heat. Lime is produced by crushing and heating limestone which is calcium carbonate (CaCO3) to very high temperatures. The heating process drives off the carbon dioxide (CO2) leaving the calcium oxide. It is often used to create very hard soils before concrete is poured to make a harder and stronger base. Lime is very reactive (extremely alkaline) and caustic and should not be used in horticulture especially gardening.

Slaked Lime or Hydrated Lime - is produced by adding some water to the Quick Lime (Ca(OH)2). This reduces the toxicity but the product is still very alkaline and should not be used in gardening. This is the lime product used to make various kinds of mortar and it is often added to cement to make it harder. Imagine what it does for your soil!

Note: Lime or Hydrated Lime may cause severe skin irritation, chemical burns, lung damage and blindness.

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Agricultural Lime - Available by many names, AgLime, biolime, garden lime, etc. It is made by pulverizing limestone and sometimes chalk into a powder.

Dolomitic Lime - Is a type of limestone that has magnesium carbonate ($MgCO_3$) in the rock in addition to the calcium carbonate ($CaCO_3$).

This discussion will be limited to Agricultural Lime and Dolomitic Lime which may have a use in agriculture and horticulture.

Limestone does not dissolve in water very easily. For agricultural lime to be effective it must be ground or screened into a powder. As the particle size gets smaller the total surface area of the particles increases. This allows for a much faster breakdown and release of the calcium (or magnesium) by microbes in the soil so the minerals will become available to plants and soil life. The "fineness" of the particle is usually described by mesh size. Mesh size is just the number of wires per inch that the screen is composed of. For example, an 8 mesh screen will have particles the size of BB's and a 60 mesh screen will have particles the size of face powder. If the limestone is larger than 8 mesh it has little or no value in gardening as the calcium is not available to plants. It costs a lot more to screen any material to smaller sizes hence the low priced products are a waste of money as they do not work.

Now that we have the basics out of the way, when and why should we use powdered limestone? The practice of using ag-lime began when one used the toxic artificial fertilizers to provide plant nutrients. Many of these make the soil acidic as they breakdown hence one must spend additional money to correct the acidity problem. This practice of applying lime is sometimes referred to as sweetening the soil.

One of the problems we face in gardening is that a pH test only tells us if the soil is acidic or alkaline, it does not tell us if we need calcium or magnesium much less about the health of our soil such as a microbial or other nutrient imbalance (In modern soil science the pH of a soil by itself is essentially worthless). Plants and soil life require far less magnesium than calcium. Hence, when we use a dolomitic lime the soils gets far too much magnesium. Sandy soils need about 7 parts calcium to one part magnesium and heavier clay soils need about a 10:1 ratio for most plants. Almost all limestone has

some magnesium carbonate in it. When the levels of magnesium carbonate are higher geologists call it dolomite. In some cases the calcium to magnesium ratio can reach 1:1. Hence when one uses a dolomitic lime they get far too much magnesium. Too much magnesium cause other nutrients to be locked up and not available to plants along with creating hardpan and compaction.

Soils, plants and microbes need calcium and it is used in creating good soil structure (helps clay loosen up and become more friable). Calcium can also replace sodium on the soil particles and on the humus helping to remediate a salt problem.

If a GOOD soil analysis indicates that ag-lime is required, then all one has to do is sprinkle it lightly over the surface of the soil (do not till as tilling does far more harm than good). If a good quality (fine screened) limestone is used the natural acidity of rainwater will quickly dissolve it and allow the nutrients to enter the soil.

Note: In organic rich soils full of microbes if there is excess calcium fungus will absorb it and form calcium oxalate crystals on their hyphae removing it from the soil system bringing the chemistry of soils back into balance naturally. Fungus can do this for other nutrients also preventing an excess from causing problems.

Summary, ag-lime is rarely needed if biological (organic) methods are used in our gardens as there are better and more cost effective ways to provide calcium to soils than using ag-lime.

PROS:

- found all over the world in essentially unlimited quantities

- increase the pH of soil making them less acidic

- provides a source of calcium (Ca) and magnesium (Mg) if dolomitic limestone is used

- helps with water penetration in very acidic soils (low pH)

- improves the absorption of major plant nutrients in very acidic soils

- on pasture land it helps cows grow quicker and stronger and helps cows produce more milk

- may help loosen clay soils

- a few species of plants need extra calcium in the soil (many species from the Mediterranean (olives and many herbs), Texas Hill country plants like salvia greggi, etc.

- for legumes it increase nitrogen fixation as bacteria prefer a slightly alkaline soil

- may help alleviate some plant diseases (ex. clubroot of brassicas and tomato end rot is often associated with a calcium deficiency)

CONS:

- takes energy to crush, screen and ship to market

- rarely needed

- too much ag-lime leads to hardpan and compaction of our soils

- as in all mineral or rock dusts it may be a respiratory or eye irritant

- many products do not list if it is dolomitic lime or the calcium/magnesium ratios

- better sources of calcium (crushed egg shells, bone meal, crushed oyster shells). Gypsum provides calcium and sulphur and does not change the pH or create soil problems from too much magnesium.