The Value of Lime to Nursery Production

by Mark Halcomb, UT Extension Area Nursery Specialist

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After making the down payment, the young farmer couldn't afford the lime and fertilizer that the soil test recommended for the field he dreamed of owning next to his Dad. You see, no one could remember the last time the land had been limed or fertilized and it was very acid, with low available phosphorus and potassium. If he couldn't afford both, should he buy the lime or the fertilizer?

His UT Extension agent suggested that he buy the lime if he could only afford one. The young farmer sure thought that sounded strange; so he did the only logical thing he could think of; he phoned the UT Extension Soil Fertility Specialist. And sure enough, the agent had told the young man right.

Lime increases the availability of the nutrients already present in the soil (1) and increases fertilizer efficiency (2). The efficiency of applied phosphate and potash may be more than doubled when the soil pH is increased from 5.0 to 6.1 because of less fixation or tie-up in the soil. Also, the availability of SECONDARY and MICRONUTRIENTS is about optimum in the pH range of 6.1 to 6.5.

(Soil reaction is whether a soil is acid, alkaline or neutral in its behavior and is expressed as pH. The pH scale ranges from 1-14, with 7 as neutral. Most Tennessee soils are acid in reaction, ranging commonly from 4.5 to 6.5. Soils with pH values greater than 7.0 are alkaline or sweet; less than 7.0 are acid or sour. A pH of 5.0 is 10 times more acid than 6.0 and 100 times more acid than 7.0 because the pH scale is logarithmic.)

The soil pH has perhaps greater influence on the <u>relative availability</u> of plant nutrients than any other single factor. This is primarily due to the influence of the soil pH on soil microorganisms and on the solubility of the different elements. Under acid soil conditions, most of the changes in soil organic matter are brought about by fungi. At higher pH values, bacteria are more active. The nitrate-forming and nitrogen-fixing bacteria require a nearly neutral soil for best development.

When soils become acid; iron, aluminum and manganese become more soluble. Available soil phosphorus combines with this soluble iron and aluminum to form insoluble compounds. When the soil becomes too alkaline from being over limed; copper, zinc, manganese and iron are precipitated and become less available for plants. These are a few examples of the indirect effects of soil pH on the relative availability of plant nutrient elements.

The Nutrient Availability Chart (Table 1) indicates the effect of soil pH on the relative availability of the different plant nutrient elements at different pH values. The width of the bars indicate the relative availability of the elements at the different soil pH levels. Where the bar is widest, that is the zone of highest relative availability; where the bar is narrow, the nutrient is less available. Note especially that this refers to relative availability and not total amounts available.

As an example, suppose the same amount of phosphate is applied to two different soils. One soil has a pH of 5.5 and the other has a pH of 6.5. Checking the chart of relative availability of phosphorus shows the bar to be much wider at pH 6.5 than at pH 5.5. This indicates that, with other factors being equal, much greater response may be obtained from this applied phosphate at pH 6.5 than at pH 5.5. It should be evident then, that by proper adjustment of the soil pH, a farmer may obtain a greater return from the investment of fertilizer dollars.

In addition to neutralizing soil acidity (3) and supplying calcium (4) and magnesium (5) (which are essential plant nutrients), lime promotes microbial activity (6) required for converting some nutrients to forms that can be utilized by plants. Example: micro-organisms convert ammonium to nitrate-M, sulfur to sulfates and enhances the breakdown of certain types of controlled-release fertilizers.

Micro-organisms also enhance decomposition of organic matter, which provides essential nutrients for plant growth. Lime improves the soil tilth (7), which improves air (8), water (9) and root movement (10) throughout the soil profile. No other amendment can influence the chemical, physical and microbiological properties of the soil as much as lime. For the cost, no other product can provide such an array of benefits.

In Middle Tennessee, nursery producers can purchase either calcitic or dolomitic limestone. Calcitic lime is composed of calcium carbonate and contains little or no magnesium. Dolomitic lime is composed of a mixture of calcium and magnesium carbonates. Dolomitic lime can be used for any crop but future hemlock blocks should definitely receive dolomitic rather than calcitic lime.

When lime is applied to acid soils, it reduces amounts of soluble aluminum (11) and manganese (12) in acid soils to non-toxic levels. When the soil pH drops to near 5.0 or below, MANGANESE TOXICITY becomes a major problem in crops such as corn, soybeans and tobacco.

For most field grown trees and shrubs, the target pH to start a multiple year crop is 6.0 to 7.0, depending on the plant species. But birch and a few other crops prefer a lower pH.

Lime also improves the effectiveness of triazine HERBICIDES such as Simazine or Princep (13). Southern blight that attacks *Malus* favors a pH range of 3-6 (14).

When needed, the correct amount of lime can increase plant growth, yields and profits (15). Too much lime can be applied, causing a multitude of problems, such as nutrient unavailability.

Although lime can be applied whenever soil, weather, crop and labor conditions permit, FALL is an excellent time for spreading. The normal freezing and thawing of the soil surface that occurs during winter may allow some of the lime particles to enter the soil. Lime should be spread UNIFORMLY. Uneven distribution may present problems for several growing seasons.

Soil test every 4-7 years, before replanting a block of nursery stock. Develop a numbering system for all of the nursery blocks in a field to facilitate record keeping. A basic UT soil test cost $7. The turnaround time is 5-10 days. I write the recommendations for nursery, not the lab. I must know the genera to be planted in each sampled area in order to recommend the correct amount of lime for each specific crop.

Although certain plants, such as azaleas, require an acid soil (low pH), they may still need some calcium and magnesium for optimum growth. Lime supplies these essential nutrients.

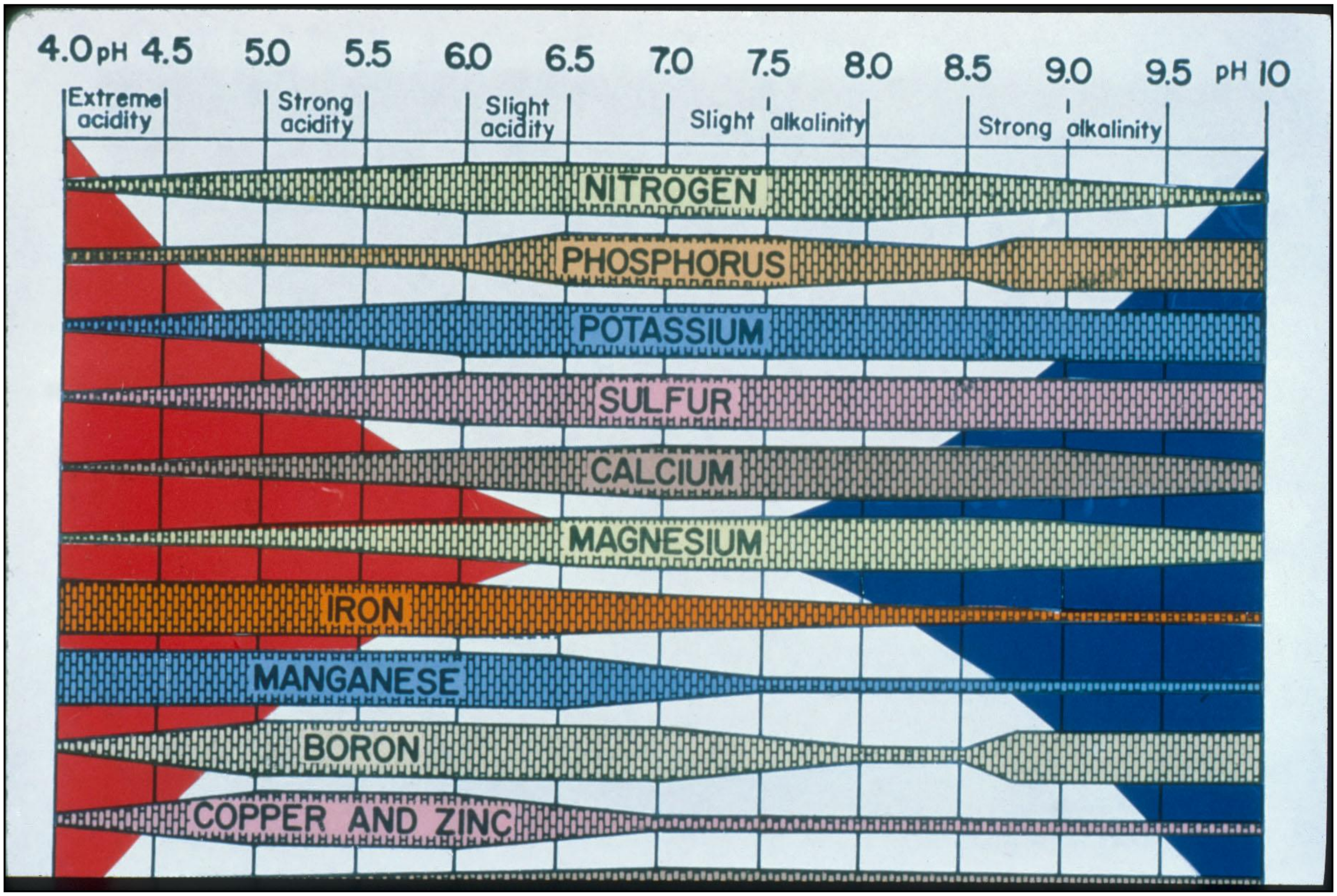
Fifteen benefits of lime were mentioned above.

Without a soil test we could argue whether a field needs zero to three tons/acre. (Never apply more than 3 tons lime/acre.) The difference in knowing and arguing about it would be an analysis. Borrow a soil probe, gather 10-20 sub-samples (from as deep as you intend to plow) per field or soil type, air dry overnight on newspaper, crumble it, mix it and fill each sample box or pint ziplock bag full. Label each with the block number or block numbers if you combined like areas / soil types with the same nutrient history.

Do not artificially dry a moist soil sample. The heat bumps the potash availability up and makes the results invalid.

NOTE: Lime is important but not as critical in pine bark container media due to the absence of the chemical factors involving soil. A pH between 5.5 and 7.0 is generally considered okay for woody ornamental container production regardless of the species. The pH of the irrigation water is also important. Irrigation water can slowly alter the media's pH if the water's pH is abnormally high or low. Raw pine bark can have a beginning pH around 4.0.

The Nutrient Availability Chart (Table 1)



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