Vegetarian Newsletter

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Increasing Lime Costs Driving Search for Alternative Liming Material Sources: Florida Standards, Considerations and Precautions for Extension Agents helping Vegetable Farmers

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As prices increase per ton of spread Standard lime material per acre, alternative liming materials are being considered and used by growers to reduce production costs of vegetable crops.

A review of the Florida Department of Agriculture and Consumer Services rules (5E-1.001 Requirements for Liming Materials and Gypsum) might be helpful (FDACS, 2009). A Standard Liming Material has a minimum neutralizing value of 90% calcium carbonate equivalence (CCE), classified as follows:

- **Standard Calcitic Liming Material** shall contain a minimum of 86% calcium carbonate expressed as CaCO$_3$. Any additional CCE required to meet the minimum 90% shall be magnesium carbonate expressed as MgCO$_3$.

- **Standard Dolomitic Liming Material** shall contain a minimum of 36% magnesium carbonate expressed as MgCO$_3$. Any additional CCE required to meet the minimum 90% shall be calcium carbonate expressed as CaCO$_3$.

- **Standard Calcium-Magnesium Liming Materials** shall be those not meeting the above specifications, but with a minimum of 90% CCE derived from calcium carbonate and magnesium carbonate, expressed as CaCO$_3$ and MgCO$_3$.

Calcium-magnesium liming materials not meeting the above specifications, but with a minimum of 75% CCE derived from calcium and magnesium, expressed as CaCO$_3$ and MgCO$_3$, shall be
considered Not Qualifying as Standard (FDACS, 2009). To be sold as a **Liming Material Not Qualifying as Standard** the material must have a **minimum neutralizing value of 75%** calcium carbonate equivalence (CCE).

- **[Not qualifying as standard] Calcitic liming** material shall contain a minimum of 70% calcium expressed as CaCO$_3$. Any additional CCE required to meet the minimum 75% shall be magnesium expressed as MgCO$_3$.

- **[Not qualifying as standard] Dolomitic liming material** shall contain a minimum of 30% magnesium expressed as MgCO$_3$. Any additional CCE required to meet the minimum 75% shall be calcium expressed as CaCO$_3$.

- **[Not qualifying as standard] All liming materials** shall bear on the application for specialty registration, labeling, and any advertising, the statements:
  
  a. “Neutralizing value ___% calcium carbonate equivalence.”
  
  b. “This product requires ___ tons (pounds) to be equal to one ton of standard liming material.”

If alternative liming materials are being considered, producers would do well to have an independent lab conduct a Complete Liming Value test where the Liming Equivalent of the material would be tested, compared to the standard. Values can vary in composition from stack-to-stack and from load-to-load in the amount of calcium carbonate, magnesium carbonate, the liming equivalent (expressed as a percent of calcium carbonate, or CCE) and particle size.

**Why Extension Agents helping vegetable growers should be concerned:**

**pH.** The soil is a dynamic media where the acidity (expressed as pH) can chemically make required nutrients more or less available for plant root uptake. Soils with a low pH can also affect plant root uptake and affect sub-optimal root growth, thereby reducing soil “mining” of nutrients by roots. Applying materials with low CCE’s will not neutralize acid as expected with a 90% CCE material (our ESTL Adams Evans buffering capacity calculations for each soil sample assumes a standard material of 90% CCE to come out with the recommended lime application per acre and so the recommendations will underestimation application rate needed).

**Dolomitic limestone as a plant nutrient source of magnesium.** Standard Dolomitic limestone must have at least 36% magnesium carbonate, which is what our ESTL (Extension Soil Test Lab) assumes when they recommend dolomite to supply magnesium as a needed plant nutrient (Hochmuth and Hanlon, 2000). Alternative materials that are not Standard Dolomitic liming materials may not provide the recommended plant nutrient required for the crop.

**The effect of particle size.** Particle size can have an effect on the rate of neutralizing soil acidity and the release of calcium (Ca) and magnesium (Mg) as plant nutrients over time. The ESTL assumes a standard material with approximately a 90-day reaction time to neutralize acid sufficiently in the plow layer, to be of benefit to crop plant roots. This rate of reaction is largely affected by particle size. The standard materials are defined by screen mesh sizes (FDACS 2009). The fine materials react first, followed progressively with larger particle sizes, ultimately
completing their reaction and neutralizing value and slow release of calcium and magnesium (if Dolomitic) over time. That is why the Extension Soil Test Lab (ESTL) recommends Dolomitic Limestone (assumed to be Standard) as a slow-release source of the magnesium (Mg), as a required plant nutrient. Alternative materials with very fine particle sizes react very quickly, producing a pH “spike” and nutrient release, followed by a drop in acid neutralizing activity and nutrient supply. Alternative materials with very large particle sizes have the opposite effect (much slower neutralizing rate of soil acid and nutrient release).

**Uniformity of non-standard material application.** Fertilizer distribution trucks and spreader wagons have been built to specifically apply standard materials. Most distribution patterns of Standard Liming Materials (as defined by the FDACS rule) are uniform across a 40-foot swath because of their particle size (FDACS, 2009). Uniform application is very important for crops. Alternative liming materials may be difficult to handle and spread because their consistency and moisture content has been different from load to load. Some farmers may have to build their own applicators and work by trial and error to get close to the application rate per acre that they have targeted. Application variances might occur, as well as skips, overlaps, and clumps of material as a result of material consistency.

During these tough economic times, the temptation is to look for ways to reduce the cost of crop production. As Extension Agents work with farmers using alternative, non-standard liming materials the following suggestions might be helpful:

- Have each stack or load of non-standard liming material analyzed for a Complete Lime Analysis from a reputable laboratory. The analysis should include Calcium Carbonate Equivalent (CCE), calcium carbonate, and magnesium carbonate content.
- Based on the load analysis calculate the application rate needed to adjust the pH to the recommended target identified by the soil test.
- Use the load analysis if magnesium or calcium is going to be provided as a plant nutrient by the liming material.
- Make sure that the farmer can apply the non-standard material uniformly with the equipment they have.

**References:**

Florida Department of Agriculture and Consumer Services, Division of Agricultural Environmental Services. 5E-1.001 Requirements for Liming Materials and Gypsum. Online [Verified 28 January 2009]. https://www.flrules.org/gateway/ChapterHome.asp?Chapter=5E-1