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EXTENSION
Institute of Food and Agricultural Sciences

HS900

Soil Testing and Soil pH Management for Vegetable Crops Grown in Florida in the BMP Era[1]

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This publication is one of a series entitled Fertilizer and Irrigation Management in the BMP Era. This series is divided into nine principles described in the Introduction Chapter (HOS-897). This publication is part of Principle 2, "Soil Test and Follow the Recommendations." BMP implementation requires a global approach to production management. However, for presentation purposes, each aspect of vegetable production is described in a separate publication.

The crop nutrient requirement (CNR) is the maximum amount of nutrient required to produce optimum economical yields. It is important to remember that these amounts of nutrients are supplied to the crop from both the soil and the fertilizer. Fertilizers should only be applied when a calibrated soil test indicates to do so.

Lime and fertilizer are essential for crop production. The most suitable pH range for most vegetable crops is 6.0 to 6.5. It is in this pH range that most fertilizer nutrients are in greatest availability. Over liming can lead to nutrient deficiencies, especially micronutrients, and it can reduce the accuracy of soil testing programs, and therefore fertilizer recommendations. A calibrated lime requirement test will result in correct liming and will also reduce the possibility of over-liming. Many fertilizer materials lower the soil pH and should therefore be considered in a liming program. From a nutrient management standpoint, proper pH management provides for optimum crop growth and better nutrient uptake and utilization by the plant.

Working Definition

Soil testing is a chemical process by which the amounts of plant-available nutrients are determined by laboratory analysis. The results of the test are used to determine the amounts of fertilizer needed for individual crops. Soil tests determine the contribution of soil-derived nutrients to the overall crop nutrient requirement.

Soil Sampling – Things to Do

- Contact your county Cooperative Extension Office or a reputable commercial analytical laboratory for complete soil sampling information.
- Divide your farm into fields or areas for sampling. Separately sample areas with different crop growth, soil color, lime and/or fertilizer

1. This document is HS900, one of a series of the Horticultural Sciences Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Publication date: January 2003. Please visit the EDIS Web site at **http://edis.ifas.ufl.edu**.
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histories. The sample you collect should be the representative of a uniform area of the field or area sampled. If a soil survey or your experience shows different soil types in a field, sample and analyze them separately.

- Sample between rows to avoid last years fertilizer bands when practicing no-till farming.
- Use the proper sampling tools, such as a sampling tube or soil auger. If a shovel or trowel is used, dig a V-shaped hole in the soil 6 inches deep, and slice a 1-inch slab off of one side of the hole. Lift out and save the center 1-inch wide vertical strip of soil.
- Take a core (with sampling tube) from at least 15 random spots in each field or area to be tested. Mix together the cores from one field or area and place approximately one pint of the mixed soil in a soil sample bag.
- Identify samples by letter or number. Make a sketch and/or record of where the samples were taken within each field.
- Fill out an information sheet and include it with payment in the box with the samples. Send samples to the laboratory for analysis. Shipping boxes are available from county Extension Offices.
- Use a competent soil testing laboratory that uses calibrated methodologies. Not all laboratories can provide accurate fertilizer recommendations for Florida soils.
- Consult with your county agent if help is needed with interpretation of test results or fertilizer recommendations.

Soil pH and Liming – Things to Do

- Test the soil and have a calibrated lime requirement test performed when water pH is <6.0.
- Maintain irrigation soil pH between 6.0 and 6.5 for most crops.
- Have a water sample analyzed for total bicarbonates and carbonates annually, and the results converted to pounds of calcium carbonate per acre. Irrigation water from wells in limestone aquifers is an additional source of liming material usually not considered in many liming programs. Include this information in your decisions concerning lime.
- Apply lime in the plow zone well in advance of the crop in order for the soil reaction to fully take place. The most common liming materials are calcite ($CaCO_3$), dolomite ($CaCO_3/MgCO_3$), burnt lime (CaO), dolomitic quick lime (CaOMgO) and hydrated lime ($Ca(OH)_2$).
- Record date, rate of application, materials used, and method of application when applying lime.

Things to Avoid: Potential Pitfalls

- Do not mix soil from contrasting or odd areas (like wet areas) with your main field sample.
- Do not use old chemical containers to mix your composite soil samples. Use clean tools and buckets.
- Do not over-lime. Over-liming and the resulting high soil pH can tie up micronutrients and restrict their availability to the crop.
- Do not let the soil pH drop below approximately 5.5 for most crop production, especially where micronutrient levels in the soil may be high due to a history of micronutrient fertilizer and micronutrient-containing pesticide applications.
- Do not apply N fertilizer containing ammonium immediately after liming to reduce the risk of ammonia volatilization.
- Avoid using large amounts of fast-acting liming materials such as hydrated lime and burnt lime since these can cause severe crop damage if used in excess.

Applicable Technical Criteria

The amount of lime to use can be found in the recommendations by the Florida Extension Soil Testing Laboratory in Gainesville.

Operation and Maintenance Issues

Keep records of the soil testing results for each field and crop.

Other Considerations

- The price of soil testing is largely offset by the fertilizer you could save. Your yields may increase if you discover that any nutrients were previously lacking, or the pH was unsuitable.
- Liming, fertilization and irrigation programs are closely related to each other. An adjustment in one program will often influence the other. To maximize overall production efficiency, soil and water testing must be made part of any fertilizer management program.
- Over-liming can reduce the accuracy with which a soil test can predict the fertilizer component of the crop nutrient requirement.
- The element calcium (Ca) is often confused with high pH. Just because Ca is being supplied to the soil, this does not mean the pH will rise. With hi-cal or dolomite lime, it is the chemistry involving the carbonate ion (CO_3^{-2}) that results in an increase in pH, not the addition of Ca.
- The use of sulfur (S) to reduce soil pH is practical only on mineral soils that have been over-limed.
- Soils normally high in pH, such as the marl and gravelly loam in Dade county, cannot be economically changed to more suitable pH ranges. On these soil types, band placement of fertilizer is an economical approach to overcoming the effect of the high pH.
- Other means to overcome high pH might be to inject nutrients via drip irrigation so that the nutrients are applied nearer to the root zone. For micronutrients, foliar application might be a suitable means to apply nutrients to crops by-passing any effects the soil might have on micronutrient availability.

Additional Readings

Soil Testing, Circ. 239, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla. http://edis.ifas.ufl.edu/SS156

Producer Soil Test Information Sheet, SL135, Fla. Coop. Ext. Ser., IFAS, Univ. of Fa. http://edis.ifas.ufl.edu/SS186

Lime and Liming – a Florida Perspective, SL58, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla. http://edis.ifas.ufl.edu/SS161

Producer Soil Test Information Sheet, SL135, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla. http://edis.ifas.ufl.edu/SS186

Commercial Vegetable Fertilization Principles, Circ. 225E, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla. http://edis.ifas.ufl.edu/CV009

Commercial Vegetable Crop Nutrient Requirements in Florida, SP177, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla. http://edis.ifas.ufl.edu/CV001

Liming of Agronomic Crops, SS-AGR-153, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla. http://edis.ifas.ufl.edu/AA128