Printed on Recycled Paper

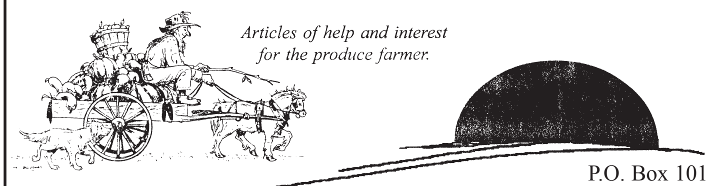
The Growers Solution

FALL 2003 VOLUME 16 ISSUE 4

Inside The Solution

Truck Patch News

Articles of help and interest for the produce farmer.



P.O. Box 101
Mt. Hope, OH 44660

Growers Program for Vegetables

This is an abridged article written by Growers customer, Reuben Byler for the Truck Patch News
Editor

Truck Patch News
Articles of help and interest for the produce farmer: Volume 3, Issue 5, May 15, 2002

By Reuben R. Byler, Dayton, PA

Although we had a dry summer last year, with drip irrigation and foliar feeding Growers 10-20-10 Nutritional Solutions we had a bountiful harvest.

Awhile back there was an article in here (TPN) asking for more information on growing produce with the "Growers Program." We have been on their program since 1993 and have not used any dry fertilizers since. One of the nice things about not using those dry chemical fertilizers is less weed pressure. We don't use any herbicides in our produce patches, although we do some hand weeding and cultivating. Using lots of High Calcium Limestone also helps to sweeten the soil which in turn helps to discourage weed growth. Weeds usually thrive in soils saturated with chemical fertilizers because most are acid loving by nature.

To my way of thinking, it is a very simple

Please turn to page 4

Rely on pH for Calcium Needs?

By James Halbeisen, Director of Research, Growers Nutritional Solutions

The many discussions in the agricultural press in recent years concerning "limestone" has had the effect of confusing farmers about the element calcium. Additional confusion follows when they promote soil pH as a method of monitoring available calcium in soil.

When Dr. V. A. Tiedjens conceived the Growers Program he believed calcium to be a very important element for healthy soils and their proper functioning, but that the pH test was not an appropriate measure for it.

In the *1938 Yearbook of Agriculture*, researchers stated, "The chemical factors underlying the relation of soil pH value to plant growth are complex. Some plants appear to be affected directly by the intensity of acidity. In other cases, a more important factor is the calcium ion concentration with which pH value is usually correlated to some degree". Because the pH test was the easiest to run, people started using it to monitor the soil's need for calcium. But these researchers went on to say, "That the pH value shown by soils bear no direct relation to the total acidity of soil. This latter quantity is measured by the difference between the total base exchange capacity and the quantity of bases liberated by a base exchangeable method of measurement. It is for this reason that pH determinations alone do not furnish sufficient information for determining calcium requirement". This statement suggests that the exclusive use of pH to determine the calcium needs of soil would be a mistake.

The textbook *The Nature and Properties of Soils* by Nyle C. Brady, used in many college soil courses, confirms that pH is a poor parameter for evaluating the calcium content of soils or its base saturation in the soil. In the book it is stated, "Since the reaction of the soil solution is influenced by three distinct and uncoordinated factors; percentage base saturation, nature of the micelle (clay), and the ratio of the exchangeable bases; a close correlation would not be expected between percentage base saturation and pH when comparing soils at random". In other words, pH is not suitable for measuring the individual amounts of various bases (namely; calcium,

Please turn to page 2

BASE CARBONATE SOLUBILITIES

From: *Handbook of Chemistry and Physics 51st Edition*

Base Carbonate		Solubility in 100 cc of Cold Water	Times More Soluble Than $CaCO_3$
Calcium Carbonate	$CaCO_3$	0.00153 grams	————
Magnesium Carbonate	$MgCO_3$	0.01060 grams	6.9
Potassium Carbonate	K_2CO_3	112.000 grams	73,203
Sodium Carbonate	Na_2CO_3	7.1000 grams	4,640
Ammonium Carbonate	$(NH_4)_2CO_3$	100.00 grams	65,359

Rely on pH

Continued from page 1

magnesium, potassium, or sodium) present on the cation exchange capacity, CEC.

It can be seen from these agricultural scientists' discussions that the pH test is a poor monitor of the calcium ion in soils, and it is the reason Dr. V. A. Tiedjens stopped using it in the 1920's.

Still, many ag consultants hold to the soil pH test reasoning that in some scientific areas the pH test is very accurate. While measuring the pH of a constant liquid solution, such as blood, can be precise and a very critical reading, the pH of a non constant liquid solution, such as soil, will not have nearly the same meaning. The accuracy of the pH test was discussed in *Soil The 1957 Yearbook of Agriculture*. "In solutions, pH is related to hydrogen-ion concentration in a straight forward matter. That is not the case for soils, which consist of a solution phase, the soil water, and a solid phase, the mineral and organic particles of the soil" (which at times become dry). "The pH of a soil-water system is an approximate reflection of the hydrogen ion concentration of the soil solution, but it does not reflect the total acidity of the system. This is because of the cation exchange properties of soils". Again, it seems Dr. Tiedjens was correct in using specific tests to measure exchangeable bases rather than relying on the all-inclusive pH test to monitor calcium levels.

Dr. Tiedjens' insistence on adequate soil calcium levels tends to add to the pH confusion when others express their beliefs that larger applications of high calcium limestone products will cause soil pH levels to raise to excessive levels (pH 8 or above), and these soils will become nutritionally imbalanced. Unfortunately, of those making these assertions, many do not have the background to understand their mistaken assumptions. Being realistic, the chemistry involved would probably never allow higher pH's to happen in the field. This is because the solubility of calcium carbonate is so very low when compared to the other base elements present (magnesium, potassium, sodium, and ammonium) which can, and do, dramatically raise soil pH. It is a known chemical principle that the more soluble the base element, the more powerful it is at creating a pH increase. *The Handbook of Chemistry and Physics 51st Edition* examines different carbonate solubilities and shows that calcium has the lowest of the agriculturally important base elements, meaning it is the weakest so far as increasing (soil) solutions to higher pH levels. According to calculations developed by Dr. Ron Olsen of Bowling Green State University, compounds such as potassium carbonate or sodium carbonate will create water solutions approaching a pH 11.0, whereas compounds such as calcium carbonate and magnesium carbonate will create water solutions closer to pH 7.0. It can be seen that because of its weak nature, calcium carbonate does not tend to dissolve well in water which keeps it from elevating pH in the field. Misleading high pH readings often result when the soil test, created in an artificial (lab) environment, has had too much water added. The resulting high pH readings do not necessarily mean there are large amounts of calcium available, because other dissolved base elements are much more likely to be contributing to the high readings.

POTATO GARDEN LIMED Monroe Ropp of Kalona, IA, spread four tons of high calcium limestone per acre on one half of his garden in 2000. This photo was taken in 2001 and it shows how his potatoes reacted. In the foreground is the no-lime part where the plants are lighter in color and smaller. In the background is the high calcium limed soil. There the plants are darker and much less of the straw mulch is showing. Monroe said when tilling the ground the change was very obvious. There was a line right down the center where the ground was finer, drier and there was less weed pressure with the calcium soil. His wife is convinced that calcium is something to put on a garden. Meanwhile, Monroe has applied 15 additional tons per acre to the garden and says they are raising a pile of muskmelons this year with the help of the Growers Program and Growers 10-20-10 Nutritional Solutions foliage sprays.

Dr. V. A. Tiedjens' reviews of others' and his own research showed that different soils have their own unique calcium requirements which he said could be attributed to the varying buffering capacities of the unlike soils. This is in agreement with the textbook *The Nature and Properties of Soils*, which states, "The several types of colloidal micelles (clays) differ in the tenacity with which they hold specific cations. This undoubtedly will affect the ease of cation exchange. At a given percentage base saturation, the tenacity with which calcium is held by montmorillonite is much greater than that by kaolinite. As a result, montmorillonite clay must be raised to about 70 percent base saturation before calcium will exhibit an ease and rapidity of exchange that will satisfy growing plants. A kaolinte clay, on the other hand, seems to liberate calcium much more readily, serving as a satisfactory source of this constituent at a much lower percentage base saturation. Obviously the need to add limestone to the two soils will be somewhat different, partly because of the factor under discussion.". Dr. Tiedjens agreed for the most part, but felt that the best soil calcium level to supply both plants and soil microbes would be at 85 percent base saturation. And to attain this level for various soils would take different rates of calcium, and it would be best to determine the optimum calcium rate for each of the farmer's fields.

At all times Dr. Tiedjens wanted the farmer to achieve economic success, meaning he wanted the farmer to apply only enough high calcium limestone to meet the soil's needs, and not to apply such large amounts that would cause economic hardship to the operation. An article recently published in the *Truck Patch News* said it best, "How much limestone should I put on? Experiment with it. Do some strip testing, apply 4 ton, 6 ton, 8 ton, 10 ton, etc. You get the idea, and measure the results".

Some articles have stated that high calcium limestone in itself has a high pH. In actuality, many high calcium liming products have a neutral pH of about 7, while dolometic (high magnesium) limestones can be as high as 7.6 pH. But how did the authors arrive at their conclusions? What instruments did they use to measure the pH, what solutions were used, and were the results expected to relate to those to be found on the farm? For example, in order to compare the pH of a limestone product in a 1 water to 1 limestone paste prepared in a laboratory with actual field conditions, we would have to apply 57 tons of limestone per acre after a ½ inch rain. Simple statements without explanation are not acceptable in the world of agricultural science. ■

pH. The technical or scientific definition of pH; "It is a symbol denoting the negative logarithm of the hydrogen ion concentration in a solution." In our everyday farm language, pH represents the relative "potential Hydrogen" of a solution.