FACT SHEET
Progressive Soil Acidification

SPANISH RIVER CARBONATITE
"Remineralizing Your Soil"

An important weathering feature in the calcareous soils of Southern Ontario is the dissolving of calcium carbonate concretions and nodules in glacial till parent material. This is because CaCO3 maintains a preserving effect and the dissolution of calcium speeds up the weathering and soil development process. In areas of heavy to moderate rainfall, like Southern Ontario, the loss of calcium from leaching and erosion is considerable. A study conducted in Ithaca N.Y., reported in US Geological Survey Circular 1017 and The Nature and Properties of Soils by Nyle C. Brady, showed the following losses on a silty clay loam:

- Bare Soil – 398 lbs/acre/year
- Rotated Crop Land – 230 lbs/acre/year
- Continuous grass – 260 lbs/acre/year

Losses to erosion, even on 4% slope, in Missouri, USA experiments showed the following:

- Continuously grown corn – 220 lbs/acre/year
- Rotation; corn, wheat, clover – 85 lbs/ acre/year

Using the best-case scenario where cover crops and proper rotation is practiced, average losses would amount to approximately 315 lbs/acre/year. Unfortunately, this is the exception rather then the rule and losses more likely to exceed 500 lbs/year/acre. According to Brady this would indicate a required application of 1.1 to 1.3 tons /acre of CaCO3 in a 4 to 5 year rotation. He goes on to conclude that the test results verify the importance of lime in any scheme of fertility management in areas of medium to heavy rainfall. Yearly losses of calcium, due to leaching and weathering, exceed all other macronutrients. This research supports our findings that soils deficient in reactive calcium are becoming a problem in Southern Ontario.

Since the focus on acid rain, scientists have been concerned that acids could deplete essential nutrients. Research starting in the 1980's has attempted to understand the effects of acid rain, particularly regions that have little buffering capability, (i.e. soils formed from parent material containing little calcium). A report, *Soil-Calcium Depletion Linked to Acid Rain and Forest Growth in the Eastern United States*, USGS, published in February 1999 explains the mechanisms set in motion with acid deposition, resulting in forest losses on the Precambrian Shield and Eastern United States.

Low pH in the A horizon of soils is caused by organic acids produced by the natural decomposition of organic matter. The organic acids percolate down into the mineral layers, which contain little organic matter. In the mineral layer the organic acids are broken down or absorbed onto mineral surfaces very quickly. Unlike these organic acids sulfuric and nitric acids found in rain water and produced by chemical fertilizers do not break down and tend to stay in solution in the mineral horizons, where weathering processes are accelerated. This results in the loss of calcium and the weathering of clay minerals mobilizing aluminum and other metals to toxic levels. After silica, aluminum is the most abundant element in the soil. Silica and aluminum combine to form one of the most critical minerals necessary for all life, high-energy agricultural clays.

The breakdown of high-energy clay minerals also results in excessive leaching due to the loss of exchange sites in the B-horizon. The increased concentration of exchangeable aluminum is taken up by roots and eventually is recycled unto the forest floors. Dissolved aluminum can also be transported to the forest floor by a rising water table. This would be the case in the Sudbury Basin where the water table is very close to the surface. Aluminum, having a greater affinity for negatively charged surfaces than calcium further displaces calcium, resulting in severe aluminum toxicity.

Acid rain unquestionably accelerates the weathering process and in the absence of calcium causes the release of aluminum. Adequate calcium maintains the base cation exchange relationship. This acidity may also increase the solubility of B, Mn, Cu, Cd, As and Ni to toxic concentrations. Phosphorous is converted to insoluble Fe and Al compounds in aluminum saturated soil solutions.

A second cause of excessive soil acidification is nitrogen fertilizer. Nitrogen fertilizer is acid forming and in any fertility recommendation an estimated 1.8 to 5.0 lbs of calcium carbonate (CaCO3) is required to neutralize the acidity generated from one lb of NH4+ nitrogen.

There are four major reasons for the depletion of base elements in your soils.

1) Large applications of acid generating fertilizer.
2) Excessive tillage.
3) Acid rain deposition.
4) Well-drained sandy soils formed from calcium poor parent material, which are prone to heavy leaching.

Aluminum toxicity is ubiquitous, meaning it effects animals, plants and microbes. In animals excessive aluminum results in neuronal damage (Alzheimer's disease). Animals, which include humans, get aluminum through drinking water, aluminum pots and food. In plants aluminum toxicity results in poor plant health, poor yields and poor nutrient content. Plants obtain aluminum through dissolved aluminum in the soil solution. Aluminum has a pronounced affect on mycorrhizal fungi resulting in poor nitrogen fixation.

Aluminum toxicity is a widespread problem and is one of the major limitations to world food production as well as reducing the nutrient content of foods. This is especially true in areas where food production is critical and population growth is the highest. Al toxicity is progressive, without remediation it will not go away. 300 ppm aluminum in plant tissue analysis is regarded as toxic and is common in soils with a pH of 5.5 or lower. Soils at higher pH and generally regarded as having sufficient calcium to resist progressive acidification can and have exhibited serious aluminum toxicity. This is due to physical and chemical soil impaction, which has created an isolated rhizosphere separated from potential alkali rich subsoil by an impenetrable hardpan.

Spanish River Carbonatite™

Singularly, the most important factor to plant health, nutrient uptake and soil restoration is the elimination of aluminum and other metal toxicities. By effectively addressing this one problem nutrient uptake, plant health and yields will be significantly increased without additional fertilizer. Ongoing trials using bulk applied SRC have shown significant results in well drained, base cation depleted acid soils, particularly where aluminum, iron and manganese toxicity is a problem. The following results are SRC test plots on calcium-depleted soils found in Southern & Northern Ontario and Michigan; take note that of major significance is the reaction time after application. All plots were established in the spring with initial tissue analysis from the plots occurring 5 to 7 weeks after application. **Spanish River Carbonatite™ is the most effective mineral input we have tested to combat soil metal toxicity**. Given credit for macro and micronutrient content SRC is not only the most effective remedy for Al toxicity, in our target areas it the least expensive high calcium mineral product.

Spanish River Carbonatite™ Applications Addressing Al Soil Toxcity

Application	Location	Al ppm	Percent Reduction	Comments
Elvin Martin - alfalfa	Marlette, Michigan			field has had 20 tons/acre of beet lime applied over 10 yr
contol		470		
1000lbs/acre SRC		166	65%	
Kerr Farms - clover cover crop	Chatham, Ontario			
contol		1181		
350lbs/acre SRC		263	78%	
Dave Deacon - soybean	Dresden, Ontario			
contol		1032		
1000lbs/acre SRC		168	84%	
Randy Hampshire - buckwheat	Marlette, Michigan			
contol		725		
500lbs/acre SRC		546	25%	requires higher application rate
Marc Atkinson - potato tubers	Shelburne, Ontario			
contol		121		plot on field which received recent lime application
1000lbs/acre SRC		32	74%	
Don Poulin - radish seed	Chelmsford, Ont.			
contol		1335		
1000lbs/acre SRC		491	63%	requires higher application rate
contol		924		
1000lbs/acre SRC		548	41%	requires higher application rate

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