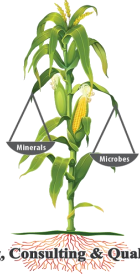


**CROP SERVICES
INTERNATIONAL**



Soil Testing, Consulting & Quality Products

In this Issue...

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Weeds, Insect, Disease**

**“To be a
successful
farmer one
must first
know the
nature of
the soil.”**

- Xenophon.

Oeconomicus, 400 B.C.

Grower Grazier Newsletter

Almost Spring 2016

Welcome Spring!

Soil samples have been trickling in which indicates that the arrival of warmer days and soils is just around the corner. This newsletter is chock-full of information about our soil testing (CEC, Saturated Paste and Biological) and how these tools are utilized to contribute to the success of any size growing operation.

Once we receive the sample, generally we have the results and recommendations back to the

Crop Services International
7700 S. Sprinkle Rd
Portage, MI 49002
800-260-7933

growers within 10 days. We pride ourselves on that! Each recom-

mendation will receive a follow-up phone call or email to discuss results and recommendations.

In November we moved into a new (hopefully permanent) location. We now have a loading dock, ample storage, a dedicated lab and soil receiving area, and ample office space to cover our needs. Please update your records.

“TASTE” Testing Soils?

by Ron Ward

Ever bite into that fruit or vegetable that pops with flavor, smells like an essential oil, and has the texture expected of that item? The “TASTE” of any fruit, vegetable, nut, forage, dairy or meat is directly correlated to the underlying mineral composition and it’s availability to the plant. For many years CSI has promoted increased, balanced and available minerals in the soil because of that “TASTE” and the associated health benefits that follow.

When you submit soil samples to CSI it is with Nutrient Dense eyeglasses that we review your results. Unless asked to the contrary, our input recommendations will reflect mined minerals usually containing multiple sources of secondary or trace minerals required for full expression of crop genetic potential. Tennessee Brown Rock is a per-

fect example as it carries 20+ trace minerals in addition to the Phosphorus and Calcium.

The availability of minerals is determined by physical (soil structure), chemical reactions (mineral balance) and biological activity. CSI’s biological analysis is covered in detail on the next page. Improving biology will improve any soils ability to solubilize minerals found in sand, silt, and clay into the forms that roots can make better use of. In order to facilitate biological availability of these minerals our recommendations will include biological inoculums and food sources. These proven products can be applied as a root dip, side dress, in-row, and in combination with foliar sprays. Using these food sources will activate the biology and they will make the minerals present or recommended plant available.

Having these minerals in soluble form will keep the photosynthetic process functioning at the best levels possible. This process is vital to growing your soil, increasing humus formation, digesting crop residue and plant utilization resulting in higher Brix readings, less insect and disease pressures and better crop storage as healthy harvests will dehydrate instead of rotting. This is minerally balanced and nutrient dense...And it's this result that shows up in “TASTE”.

We look forward to working with you to improve the T-A-S-T-E of your soils this year!

Tastefully submitted,

Joe, Dane, Ron, Ryan,
Nancy & Chuck

Soil Testing: CEC, Saturated Paste, LaMotte and Biological & Recommendations

When you send in a soil sample to Crop Services International for analysis, the report you receive will give you a good idea of the mineral nutrients present in EXCHANGEABLE and SOLUBLE form in the top six inches of the area you wish to grow. The primary exchangeable nutrients are Calcium, Magnesium, Potassium, and Sodium. These minerals are positively charged called "cations", and this charge causes them to adhere to the negatively charged particles of clay in the soil. Soils with a greater proportion of clay in their makeup have a greater capacity to gather and hold onto these major nutrients. This is called the CEC or TEC; the Cation Exchange Capacity or Total Exchange Capacity.

What do we mean by "exchangeable?" As plant roots reach into the soil they secrete or exude sugars,

carbohydrates, and proteins in a slightly acidic form. This acid gently scours the sand, silt, and, clay and the positively charged cations are pulled off the clay and are now in soluble form for the roots to absorb. The roots exchange their exudates for the minerals they need to build their plant structure.

Also tested are the negatively charged "anions" including Phosphorus, Sulfur and Boron. This negative charge means they are repelled by the negative charge of clay. Fortunately, Carbon in the Organic Matter has lots of attachment points and will hold both

Carbon in the Organic Matter has lots of attachment points and will hold both the cations and anions.

the cations and anions.

This is the way that plants get what they need through soil chemistry; and this form of testing is one way to assess the fertility of your soil.

Soil Testing:

The CEC (Cation Exchange Capacity) test uses a strong acid to measure thirteen vitally important minerals. Results are indicated in lb/acre and balance (base saturation percentages). This test is the primary soil test used in agriculture for determining soil mineral/balance content.

The LaMotte test was developed by Carey Reams in an attempt to give a more accurate indication of what nutrients were available to the plant roots. The LaMotte test uses a milder acid

than the CEC test and more-or-less indicates how available minerals are to the growing roots. These results will vary from day

to day and within the day, so CSI only uses these results as an indication of nutrient availability at that time.

The Saturated Paste test uses water to extract nutrients and provides information about the water soluble nutrient in the soil solution. In general, because of using water, Paste results will be less than LaMotte. This test is used as a tool to trouble shoot problem soils.

Comparing CEC and Paste dramatically shows the difference between "Exchangeable" minerals in the sand, silt and clay, and the "Soluble" nutrients currently present in the nutrient form in the

soil solution. This is a great indication of immediate needs of soluble nutrients.

Recommendations:

The mineral level "targets" indicate the amount of each mineral that would be ideal (based upon that soil's CEC). Input recommendations utilize mined mineral rather than chemical fertilizer applications since chemical inputs often tie up minerals and/or are hard on microbial life. Minerals are the key to plant and animal health and mineral balance is the key to good soil structure, so proper levels are important.

Each trace mineral has an essential role in plant and soil health e.g. Boron is essential to getting Calcium into the plant rootlet. Silicon starts the Boron process. Zinc is important for growth and aids the plant in moisture uptake. Manganese is a mineral needed for producing seed.

Trace mineral additions can be expensive and growers may be tempted to ignore recommended applications. It's important, however, to allocate some resources even if you decide to cut the recommended amounts in half or more. Taking four years to bring levels up is better than not starting at all. Many growers are choosing to use a lesser amount in broadcast application and then supplement with a dry or liquid fertility program containing trace minerals in the row, side dress or foliar application. This approach will feed the plant and slowly build levels in the soil.

In addition to plants using exudates to solubilize minerals, the microscopic creatures of the soil have been partaking of the same exudates streaming from the roots. It's the sugars and carbs, the foods that all biological creatures, even

us, need to provide energy for all of life's processes. Hundreds of different species of bacteria and fungi form colonies surrounding the tiny root hairs happily slurping up the goodies. Now these tiny beasts have their own methods of pulling the minerals into their own bodies. Fungi produce acids much stronger than root acids in order to solubilize the minerals around them. The fungi then trade these soluble minerals for the energy foods that the plants make available. Bacteria accumulate minerals transforming the inorganic rock minerals around them into protein form as parts of their own bodies. Protozoa, which are a family of microbes including flagellates, amoebae, and ciliates, love to eat the mineral-rich bacteria. As they digest the bacteria and excrete what they don't need, the protein forms of the minerals become soluble forms that the root hairs can absorb. Beneficial nematodes do much the same, eating bacteria and fungi and producing soluble nutrients from their waste.

This form of nutrient cycling happens, independent of pH issues or other chemical interactions in the soil that can render some minerals unavailable. In soils with low biological activity, these chemical tie-ups can keep needed minerals out of the plants. This can reduce yields and lessen the nutritive value of the crops.

Biological Testing:

Biological testing is an additional service offered by CSI. This Qualitative Analysis is performed through direct microscopic examination of the Bacteria, Fungi, Protozoa and Nematode. Population, diversity, balance and activity levels (or lack thereof) of the microbes

(Continued on page 3)

Soil testing continued

gives a good picture of overall biological health. The results can be indicators of potential problems, such as pathogenic fungi, root-feeding nematodes, and anaerobic conditions that might compromise the crop's health.

The laboratory process is to take the sample and break up any clumps to get the texture of the material as crumbly as possible. This crumbly sample is thoroughly mixed to get the best representative sample. From that mix, a small amount of the mixture is mixed 1:10 with distilled water. This allows the soil particles to separate and the soil microbes can float freely making it possible to observe them beneath the microscope lens.

Nematodes, which are easy to spot since they are much larger than bacteria, are counted and classified according to their function as determined primarily by their mouth parts. Some are bacterial feeders; some feed on fungi; others eat other nematodes. These nematodes are beneficial, transforming their prey into food packets for the nearby roots.

If root-feeding nematodes are observed this indicates poor soil conditions usually caused by low Oxygen levels in the soil, low humus or lack of competition from beneficial nematodes.

Bacteria counts are estimated (their numbers can and should be in the thousands per field of view). The various species of bacteria can be differentiated by their shapes and sizes. We also get an idea of the activity or dormancy of the little guys.

Fungi are inventoried by observing strands that are seen on the slide. Different species are categorized according to color and

the width of the fungal strands. Darker colored strands (called hyphae) are usually the beneficial fungal species. An even better

SCIENTIFIC BREAKTHROUGHS



"You'd better get Joseph Miazgowicz down here right away. That's the darndest little teeny weeny squiggly thing I've ever seen."

indicator of a welcome fungal species is hyphal diameter - the wider the better. Virtually all of the disease-causing fungi are extremely narrow in width.

In the first examination we are on the lookout for any **protozoa**. Often they are in dormancy, since they rely on moisture in the soil to swim in to get from place to place looking for food and the soil is usually dried out before it lands on our desk. It can be hard to spot the sleeping little critters, so we put the sample aside for 24-48 hours, allowing the "protes" to wake up and start moving around. We classify the types of protozoa into flagellates, amoebae, and ciliates. Groups of protozoa consisting of mostly flagellates and amoebae with maybe a few ciliates indicate good Oxygen levels in the soil and good prospects for efficient nutri-

by Joe, Dane and Ron

ent cycling and continuous Nitrogen availability.

Finally, recommendations are given on methods to be considered

This work is done 24 hours a day every day throughout the season.

By assessing the biological condition of the field, we can get a clear idea of what may need to be done to get this natural system up and running or to fine-tune it to get crop response. If the overall populations are low, the CEC test results may tell us what we need to do to get a mineral balance more favorable to good soil structure. For instance, a soil with too little Calcium or too much Magnesium will squeeze Oxygen from the soil creating difficult conditions for the beneficial bacteria and fungi to thrive. Low fungal numbers or diversity can point to problems with over-tillage, destroying good soil structure. Protozoa or Nematodes might be missing which can lead to poor mineral absorption by the crop.

Bio-activation will be included in each recommendation and involves adding food resources such as fish, kelp and molasses. Some situations may call for inoculation of specific microbes using biological products or general inoculations through compost and compost tea applications. Once working efficiently in the soil these microbes can begin to access mineral stores from deeper in the soil than is normally tested. Once this condition is established, the minerals from the upper six inches of soil will not be mined so heavily by the plants; their nutrition coming now from deeper layers in the soil. As these deeper layers are accessed the soils ability to capture and maintain both moisture and Oxygen improves, providing drought resistance and greater stalk strength to the crop.

to improve the balance of microbial families and to promote the expansion of the Oxygen-bearing aerobic zone in the soil. Achieving a deep and wide aerobic ecology in the field will improve yields and quality of any crop you wish to grow - whether a small backyard garden, a lawn or sports field, a small farm market garden, row crops, orchards, vineyards, or pastures.

Without biological activity in the soil, the crop will have to rely on the farmer for regular inputs of soluble nutrients in the amounts and at the times they are needed. By maintaining a diverse host of living soil workers, much of the farmer's concerns are met by the work of the "wee beasties" in the soil, pulling the minerals from the rocks, transforming, and spoon-feeding them to the plants above.

Foliar Feeding

Our definition of foliar feeding is supplying nutrition in the form of minerals & microbes to the leaves, blossoms, fruit, stalk and stem as plants feed through the stomata AND the epidermis. Foliar feeding can stimulate plants under stress due to weather conditions, less than ideal soil conditions and during critical points of influence.

In 1961, Sylvan Wittwer sought to determine the rate of absorption of nutrients through the outer cell structure of a plant. Using Phosphorus and radioactive isotopes he compared the rate at which the Phosphorus absorbed into the plant comparing foliar application to root application. His data showed foliar applied nutrition was (100-900%) more efficient than soil applied nutrition. With particular minerals it can be absorbed as fast as 30 seconds. Sjoerd Smits of NovaCropControl in the Netherlands has 10 years of research using plant sap analysis that verifies those findings. Through sap analysis they have data proving that most minerals alone or in combination will give positive response in terms of plant sap readings. Using foliar feeding techniques they have compiled data for ideal mineral levels for most plants...including weeds.

Foliar feeding seems to be the big rage today and with

good reason. Farmers employing "foliar feeding" into their arsenal are recognizing benefits in quality, yield, pest and disease suppression and overall plant health. For these reasons companies are developing "foliar" products which typically consist of a combination of minerals, with various amounts of humic or fulvic acids, fish, kelp, molasses and microbes.

CSI has been promoting foliar applications for many years using fish, kelp and molasses with various minerals. Since compost tea has become so popular many products are also including individual or consortia of microbes along with the minerals.

Growers are using foliar applications to supply soluble mineral nutrition applied directly to the foliage. There are critical points of influence where foliar feeding produces great crop response benefits even if the soil isn't perfectly balanced.

These critical points of influence correspond to the growth stages of the plant. Having balanced, and sufficient mineral nutrition is imperative to fully recognize the true potential of any plant.

The Living Stone Organics "Five Touch" program has

developed products that can be foliarly applied for three of those critical points of influence. These growth stages require specific energies to promote growth and rooting and provide the microbes for plant protection. **Growth Plus** is one such product that

Having balanced, and sufficient mineral nutrition is imperative to fully recognize the true potential of any plant.

includes the growth energies (Calcium and Nitrogen), rooting energies (Phosphorus and Potassium), and trace minerals through kelp with Sulfur to supply necessary mineral nutrition to sustain the plant into the reproduction stage. At this time **Bloom Plus** is designed to temper excess Nitrates thereby holding on to the blossom and encouraging fruit set. **Jackpot Plus** has fruiting energy including Potassium which is needed for filling fruit. Other products we recommend during foliar applications are microbes that perform specific functions like our nitrogen fixer- **NutriFoliar**. This bacteria lives on the leaves and fixes atmospheric Nitrogen into a protein that the plant can feed on. It should be applied at least twice during the growing season as the microbes only survive about 30-40 days.

Not every mineral can be absorbed by the plant, but

by Dane Terrill

many of these minerals, especially the trace minerals, along with the microbial interactions create enzyme cofactors that create enzymes, metabolites, lipids and fats, a sign of true plant health.

Our recommendations include the use of foliar feeding on most crops when equipment is available. Equipment can be as simple as a watering can, although the finer mist of a pump or backpack sprayer is advisable. For larger acreage boom sprayers, irrigation pivots, orchard misters and aerial application with an airplanes and helicopters are utilized.

For row crops, pastures, and forages foliar applications are recommended 2-4 times. For high-value crops foliar applications are suggested every 10-14 days. Successful growers are recognizing big cost to benefit ratios including improved overall plant health and vigor, better fruit set and fill, less disease and pest outbreak and more marketable yields. Foliar feeding has proven benefits in a wide variety of crops and soil conditions.

Consider adding foliar feeding to your "tool box". CSI carries a full line of foliar products that can enhance any growing operation.

800-260-7933

Lawn and Landscape Maintenance Choices

When you consider your choices for your lawn this spring consider these concepts. Conventional wisdom is to hurry out and start applying chemical Nitrogen onto the yards. This will produce a burst of new green growth above the soil! Yay! Green Grass!

But there is a cost. Below that green top growth there are many other things happening as well. The explosive growth above the ground draws the plant's energy away from its root system. The grassroots thus end up being short and stunted. Short roots increase any plant's susceptibility to drought, disease, pests, and possibly death. This becomes evident in July and August when heat and humidity increases fungal pathogen activity (dollar spot, Pythium and a host of other turf diseases). Additionally, most chemical nitrogen

fertilizers are salts – harmful to beneficial soil microbiology.

If you find it necessary to apply something in the early spring, use biological foods like fish, kelp and molasses. This will jumpstart the biology in the soil and enable plants to get a sustainable start. Our organic lawn care business in Michigan has had great success using "Growth Plus" from Living Stone Organics. This product has a full complement of microbes from worm castings, minerals like Calcium, Phosphorus, Potassium, Sulfur and yes a "little" Nitrogen. This nitrogen is in a protein form that won't leach or volatilize. Using compost tea will give similar results.

This approach allows microbes to liberate the nutrients from the soil and the air necessary for top growth and root growth. Deep roots increase the plants connection to the soil. These deeper roots provide more volume for the plant

to exude photosynthetic products that feed beneficial soil microbes and increase the plant's resistance to drought with longer root that will access deeper water reserves. Beneficial soil microbes provide a vast array of services for the plant. They fix free Nitrogen from the atmosphere, solubilize stubborn minerals, and cycle all of these nutrients in a way and place that is convenient for the plant.

Working with the natural system produces stronger plants, healthier soil, and more stable ecosystems. We seek to feed the beneficial soil microbiology, accelerating its recovery. The way the yard is maintained will help immensely!

Irrigation: If the yard is irrigated it needs to be irrigated only sparingly, beneficial microbes require moisture, not a swimming pool.

By Ryan Bos

Mowing Height: Increasing the mowing height above 3" is critical to out-compete light loving weeds while increasing its own photosynthetic capabilities.

Mulching: Grass clippings and leaves should be mulched back into the soil. 1/3 of your Nitrogen needs for the year can be accomplished by mulching.

The natural system has been feeding plants for millions and millions of years. And working to restore this system is the best way to increase the resilience of your yard, build the health of your soil, and even contribute to carbon sequestration, and remediation. Because no harsh chemicals are used on your property, you and your animals will be free to wander barefoot without any ill effects from chemicals.

Growing Problems: WEEDS, INSECT PESTs and DISEASES

In spite of our best practices we can still be challenged by Weeds, Insects, Diseases and Conditions. The following article will address each of these and give you ideas that may help you avoid or deal with them.

The "Conditions" I'm referring to are those visible conditions of the marketable part of your crop that would tend to make it unsightly or unmarketable. Conditions are usually caused by lack of a certain major, trace or rare earth mineral. Examples are Hollow Heart in cauliflower, strawberries & potatoes; Blossom End Rot in tomatoes; and Bitter Pit in apples. These diseases are caused by a shortage of mineral

nutrients usually Calcium and Boron not by the disease organism itself. (Boron deficiencies are common in most soil tests.)

Other "conditions", such as failure to set fruit (lack of Manganese or excess growth energies); aborting blossoms or dropping of fruit (excess nitrate); "necking" of a squash or cucumber (reduction of the caliper or circumference) is due to reduction of K uptake; twisting of corn rows (due to a variety of stress factors); hollow stems in grains and alfalfa; are all lack of (or excesses of) nutrition. Sometimes the nutritional lack/excess is caused by weather conditions and may not be visible without very intense crop monitor-

ing. Examining the insides of stalks or fruits/heads/grains at all stages of growth is recommended. You can accomplish that at the same time as your brix, pH and ERGS monitoring. On high value crops, it would be advisable to invest in a tissue analysis at least once a season. If your soil isn't quite where it needs to be, the use of foliar applications of products like GROWTH PLUS, BLOOM PLUS and JACKPOT applied at specific growth stages can supply the necessary energy to reduce these conditions and achieve a quality harvest.

Insects and diseases are also nutritional problems, but the approach is slightly different. Monitor-

ing a plant using Brix, pH and ERGS can identify potential energy problems. If Brix reading drops below 12 (or lower than the surrounding plants) insects will have the ability to eat your plant. Above that level the insects cannot digest the sugars and will leave your plant alone, hopefully attacking the nearby weed.

Monitoring sap pH can be a useful tool to identify when additional energy needs to be applied. It has been proven that keeping the sap pH close to 6.4 will alleviate pest and disease problems. It is almost impossible for you to know the surface pH of your crop leaves,

(Continued on page 6)



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Mission: To provide the most advanced soil testing, technology and proven quality products to enable farmers and growers – of all types and sizes – to improve the health of their soils, crops, livestock and humanity.

Growing Problems (Continued from page 5)

however the arrival and survival of a fungal organism is dependent on surface pH being below 6.4. Above 6.4, the fungal organism can't grow a hyphae or foot that allows it to penetrate the tissue and feed on the plant juices. The research was proven by Cornell and a baking soda and seaweed based fungicide soon followed.

Our recommended approach if fungal/blight/rust outbreaks are occurring in your neighbor's field is for you to spray with Calcium, Potassium, Sodium, Boron, Phosphorous, and kelp to raise brix. Ideally this will provide a high pH barrier against the fungal organisms. Recommended sources and rate of the above nutrients are milk powder (Calcium, Potassium and Phosphorous) 8# of milk powder or one gallon fluid milk, Sodium &/or Potassium carbonate or bi-carbonate, (sodium bi-carbonate is household baking soda) 2-3 cups, sodium borate (Borax) 1-2 cups and 1 pint of SeaCrop16. An alternative

is our soluble minerals and microbes product COMPLETE-1/2 lb with our foliar nitrogen fixer NUTRIFOLIAR-125 ml this will enhance the energy (Brix) and will help keep the bad guys from gaining a foothold. COMPANION is an EPA registered biological fungicide that shows disease suppressive capabilities as well. With either approach use enough water to coat the plant. You may have to repeat if rain washes off your barrier. Try to keep crop coated till the "fungus period" has passed. Liquid fish is avoided in these formulas as fish is acidic.

If you already have fungus on your plants, spray/drench with a 2.5 % peroxide or bleach solution FIRST! Wait until the next day and then spray the protective nutrient and biological barrier listed above.

Fungi are present in nature to consume dead cells. Therefore, you can make the assumption that any plant being attacked is already nutri-

tionally deficient and/or already has dead cells before the fungus takes hold. Utilizing foliar feeding to provide good mineral nutrition to

the plant is the best way to keep the plants healthy thereby suppressing fungal outbreaks.

Weeds are responsive to soil conditions: nutritional, structural, temperature, moisture, air spaces, humus levels and microbial type and activity. The least weed pressure happens when you have mineral balanced, biologically activated, flocculated soil. We know that excess available Potassium readings in relation to available phosphate readings will encourage broadleaf weeds. We also know that low Calcium content and/or availability will encourage grasses.

For years, growers have used a mixture of 2 gallons each of molasses and liquid calcium in 20 gallons of water per acre as a grass/weed suppressant. The mixture is sprayed within 24 hours of last soil disturb-

ance which is usually the planting stage. Savvy growers have rigged up booms behind planters to cover that step in one pass over the field. The same thing can be done during an early cultivation to give suppression until canopy cover. Many growers are seeing good weed suppression using our micronized mineral product PHOSCAL 30 and/or our liquid PREMIUM CAL 33. Both have been reported to be effective. It is necessary to use the molasses with either as the molasses activates the phosphorous releasing bacteria. It even works on rice!

Experience has shown that the continued use of both our Nitrogen fixing & Phosphorous releasing microbes and our Micronized Mineral line adds accumulating benefits to soil and plant health which can better help you avoid the challenges of weeds, insects, diseases and conditions.

Finally, check our website for updates on new products and programs. **Happy Growing!**

Fungi are present in nature to consume dead cells and weak plants.