



The Soilsmart Newsletter

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Building soil structure, increasing moisture retention, dealing with soil compaction, & the dichotomy of growing trees and turf together.

To grow healthy, productive, disease free plants you need healthy soil with the right balance of beneficial soil organisms.

In practice however, the tendency in many landscapes is for poor amounts, and out-of-balance ratios, of soil micro-organisms, which has adverse effects on plant health. Achieving the correct biological and chemical balance in the soil is not an easy task, because different plant groups have different biological and chemical needs. A most common issue is the dichotomy of growing trees and turf together, which often results in the trees being under constant stress.

At Soilsmart, we can measure the quality and quantity of soil organisms and help you develop inexpensive and practical programs to build the life in your soil to grow healthier plants that achieve extraordinary results.

SO HOW DO YOU PROCEED?

1. Measure and test the current condition of the soil and surroundings. Measure and test soil compaction levels.
2. Determine the soil biological balance required by the plants (fungal or bacterial dominance)? Soil biology assays let you know the amount and types of soil organisms present, as well as, what the desired ranges of these organisms are for the plants you are working with.
3. What is the current chemistry of the soil? Any dramatic imbalance or deficiency in soil chemistry should be addressed at the start of the program.
4. Soil testing will also determine soil organic matter to determine what additions are required to promote an appropriate environment for soil organisms to be grown.

CREATING THE RIGHT ENVIRONMENT

After you have your background information, the job is to provide biological inoculation, organic matter and the correct foods into your system to grow the beneficial microbes needed in the soil.

Bacteria and fungi are decomposers of organic matter, so obviously if the right kinds and amounts of organic matter are not present, the decomposers won't be either. Protozoa and nematodes are predators of

bacteria and fungi, and after they feed plant available nutrients are released and cycled back to the plants. This is how plants are fertilized in natural systems, and sustainable landscape systems. (Some species of nematodes feed on other nematodes, and some feed on plants in unhealthy soils).

Deciduous trees grow best when there are about 10 times more fungi in the soil than bacteria. One of the key reasons for this is that in a fungal dominant soil the fungi release organic acids, which buffer the pH on the acidic side. While in a bacterial dominant soil the pH will be buffered closer to the 7 range.

The nitrogen released from the predator-prey interactions described above is released as ammonium. The pH in the bacterial system favours the growth of nitrifying bacteria, which will convert nitrogen in the form of ammonium to nitrate. Woody plants grow best in a fungal dominant soil, where ammonium is the dominant form of nitrogen available.

So what happens when trees are grown in a more bacterial system, like a lawn, and nitrate is the form of N present? The roots don't know the difference, they are just a sponge, and so they take it up. Nitrate promotes lush growth but it leaves less starch free for the plants natural defence mechanisms. With trees this translates to more food for leaf feeding pests, and less energy to protect against borers etc.

RESULTS!

Good, healthy & well structured soil will hold water against the flow of gravity in the structure created by the activity of soil microbes, organic matter and larger soil organisms such as earthworms. This is the same mechanism that works for trees in a natural forest system. Since the organisms are regulating the soil chemistry in this situation, the correct pH and form of plant available N are a standard by-product of the correct soil biology being present, external disturbances notwithstanding.

Water retention and soil health are two major factors to reducing stress in trees. Another great benefit from improved soil biology is that shed leaves, potentially harbouring pests and diseases will be decomposed, not only providing organic matter to the soil, but also dramatically reducing pest and disease populations which may otherwise over-winter in the soil or on leaf surfaces.

As the soil biology improves and comes closer to balance we find that trees do not have to be on life support.

WE NEED TO CONSIDER THE CONDITION OF THE SOIL BEFORE APPLYING MICROBES.

1) Well-structured?

If there are lots of passageways to let air and microbes through, there is likely to be no problem with the organisms getting into the soil.

2) Slightly compacted soil?

The organisms will set this right, building the structure needed, as long as they have the needed foods to help them stay alive.

3) Significantly compacted?

More biological inoculum may need to be added. Several applications may be needed, as the first set of organisms may not survive. Food must be added, but must be added with care. Too much will drive the soil anaerobic as the organisms grow faster than oxygen can diffuse into the soil.

4) Very compacted?

We may have to open up the structure of the soil physically to allow the organisms to move into the soil. They may not be able to move into and survive in soil where there is a black layer.

CONVERSE ISSUES IN TURF MANAGEMENT

Modern turf management, like many land management practices is facing pressure to become more sustainable. In contrast, the pressure to produce a quality disease free playing surface continues to place its own pressure on managers to continue with traditional management practices and the continued use of ineffective irrigation systems, chemical fertilizers, fungicides, pesticides and other biologically destructive chemicals.

Interestingly the cause of most if not all of the issues faced by turf managers is also linked to poor soil health. This is particularly evident when dealing with intensively managed putting and bowling greens. As a direct result of chemical use, turf grasses are (more often than not) growing in a substrate which is biologically weak, has little or no capacity to hold nutrients and is consequently pre disposed to disease and stress factors. As a result the greens need constant attention (watering, feeding, disease and pest control, de-thatching, coring/slicing) and so on, to simply maintain a playable surface.

Of course there hasn't been a clear or comprehensive alternative for those interested in finding a better way to proceed. Les Ruse at Wollongong RSL Bowling

Club is one such pioneer, he decided some time ago to concentrate more of his effort on increasing the health of his soil, as a means to reducing input costs and improving safety for himself and his staff.

Having tried different products and approaches over a period of four years with varying degrees of success, Les soil samples away (from greens 2 & 3) for biological analysis in March 2004. The results of the samples revealed that with the exception of bacteria, most biological groups (particularly beneficial fungi) were well below acceptable levels.

In consultation with Soilsmart Horticulture Pty Ltd (SSH), Les began a remedial program in May 2004, which involved biological inoculation and stimulation. Because the surface couldn't be disturbed at the time, the initial program concentrated on monthly applications of SSH Soil & Plant Tonic - a liquid biological inoculant, followed by bio foods to stimulate soil biology. In September 2004 (following four applications of SSH Soil & Plant Tonic, greens 2 & 3 were re-sampled and sent for biological analysis to assess the performance of the remedial program.

Most significantly, the September results show an increase in fungal resources (the initial focus of the remedial program). In particular Vesicular Arbuscular Mycorrhizal Fungi (VAM) had moved from being totally absent to more than 50% infection in green number #2 and 19% in green number #3.

Since March 2004 Les has noticed -

- ✓ An increased depth and vitality of the roots.
- ✓ Up to 50% more clippings from treated greens.
- ✓ Treated greens are using less irrigation.
- ✓ Treated greens are holding on in hot weather
- ✓ Disease pressure has reduced significantly – Les has not used fungicides at on treated greens (as at January 2005).

| Test Date | Active Bacteria | Total Bacteria | Active Fungi | Total Fungi | VAM | Nematodes |
|-----------------|-----------------|----------------|--------------|-------------|---------------|--------------|
| 24/03/2004 | 63 | 51 | 8 | 34 | 0 | 3 |
| 22/09/2004 | 50 | 27 | 28 | 3 | 44 | 8 |
| Target level | 40 | 50 | 40 | 50 | 50 | 67 |
| High Level | 100 | 100 | 100 | 100 | 100 | 100 |
| % Change | -21% | -47% | +247% | +55% | +3450% | +175% |

September Results - Average of Greens 2 & 3

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