Green Side Up

July
2022

Ringwood Bowling Club

I was looking through some older files on my computer whilst self isolating due to Covid, and found an interesting analogy and thought I would share it with you. In parts it is a bit technical, but I hope you will find it interesting.

The human body is a biome – by definition, a large, naturally occurring community of flora occupying a major habitat – that I realised the full meaning of soil life and how interconnected it is, I am a long-standing greenkeeper, but it is only in the last 10 years or so that I have come to see just how much microbiology permeates every aspect of our lives. Although theoretically and mechanistically I knew this a long time ago, and was aware of the importance of soil biology and mycorrhizal fungi, it was only in 2012 that it really began to dawn on me how understanding the intimate, biological and symbiotic processes involved in my own digestion sheds light on the equivalent processes taking place in the soils of the greens in my care.

In 2012 I heard a conference speech by Dr Elaine Ingham about the remarkable recovery rate – up to 80% – of patients with digestive infections after they had received fecal microbiota transplants. Where antibiotics had been detrimental to their health, introducing healthy bacteria from stools had restored their colonic microflora. Whilst I found that fact somewhat disgusting, it was a fascinating fact.
It was through understanding that to all other ecosystems. The dark mysterious world of soil biology is rarely brought to the daylight of people's understanding, even in the organic movement, due to the assumption that this is reserved for the in-depth investigations of soil scientists. However, if we understand this science only in terms of the earth beneath our feet, we miss out on seeing the awe-inspiring interconnectivity of soil with the rest of life.

Parallel digestive systems

The key concept that has changed my thinking on greenkeeping is to understand that the soil surrounding a plant's root zone is effectively its digestive system, or 'stomach'. Building on this parallel, my body breaks down the food I eat in an internal and, mainly, but not exclusively, anaerobic process that involves symbiotic communities of bacteria, which occupy the stomach, small intestine and large intestine. Nutrients are absorbed through the huge surface area of villi lining the gut, a process that is mirrored in the soil, although with plants the absorption is outside-in rather than inside-out. It is in this sense that the soil and its bacterial and fungal community can be seen as analogous to an external stomach of a plant, since these organisms, including a network of mycorrhizal fungi, play a central role in breaking down organic matter into absorbable nutrients, which are available to plants through their large surface area of root systems.

Although these processes in the body and in the soil function differently, there is a fundamental link – the digestive system. This system refines and transforms the material from one organism, which occupies a low place in the food chain, to nourish another, further up the ladder. Through digestion, organic materials are broken down and transformed into new life forms: the soil biome nourishes the plant through complex digestive processes in the rootzone and rhizosphere. The health of all these interconnected organisms is, therefore, centrally dependent on the health of their digestive processes.

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. **The secret world of microbes**

At the microbiological level, there is something utterly compelling about the digestive process. This microscopic world opens up a new dimension of understanding in relation to the health connections between the life of the soil and the organisms that live inside our bodies. In the human gastrointestinal tract, approximately 1.5kg–2kg of non-human life forms, mostly beneficial bacteria and also other microorganisms, help with the process of digestion, enabling the subsequent absorption of short-chain fatty acids, while living off the energy produced by the fermentation of undigested carbohydrates.

As well as digestion, microbes perform various other vitally important roles in regulating the immune system and preventing colonisation by pathogens. The study of microorganisms, through research such as the Human Microbiome Project, has opened up new doors for understanding health. Similarly, the Earth Microbiome Project is systematically characterising the microbial diversity across the planet.

Even mainstream soil scientists are now beginning to present us with a new and clear message that microorganisms are crucial for soil health – even though we are only just coming to realise how important they are also for our own health. The layer of healthy topsoil, thriving with microorganisms, which covers much of the land’s surface, is in effect a vast digestive system – the collective stomach of all plants, breaking down soil nutrients into bio-available forms that plants can absorb. The rhizosphere, or root ball, is the gut of the plant and the zone where plant roots and soil organisms interact in a whole variety of biotic, symbiotic and pathogenic relationships to enable these organisms to do their work. Plants secrete weak acids to dissolve minerals in the soil then draw these back up in solutions. They also secrete a portion of their photosynthetic energy through their roots as chemical exudates in the form of carbohydrates and proteins, which attract and stimulate the growth of bacteria and fungi.

Without the presence of microorganisms, the mechanics of the digestive system can still function to a certain degree. Purging our intestines of microorganisms through antibiotic use will not stop us from digesting food, just as bypassing the soil ecosystem through using chemical fertilisers or hydroponics will still stimulate plant growth. However, the long-term vitality and health of plants, animals and people is centrally dependent on the presence and diversity of microorganisms, in the soil and gut respectively.

Soil microbial communities are considered the most biodiverse in the world and it is estimated that a single teaspoon of garden soil may contain thousands of species, a billion individuals and one hundred metres of fungal networks. However, only 1% of microbes that live in the rhizosphere have so far been identified by scientists due to difficulties in getting them to grow in the laboratory. “We know more about the stars in the sky than about the soil under our feet,” says US microbiologist Elaine Ingham. Despite the lack of scientific knowledge of the specificities of soil microorganisms, the impacts of destroying soil biodiversity by failing to maintain sufficient organic matter, the overuse of chemicals and heavy tillage are obviously detrimental for soil health and fertility.

Microbiomes as the key to good health

The biodiversity of the organisms in our guts is also crucial for maintaining health. In the human microbiome, this is determined by the specific condition of each section of gastrointestinal tract. However, the compositions of microbial communities are different among people, because the ecological conditions of individual intestines are distinct depending on age, body condition, diet, lifestyle, geography and cultural traditions. Gut microbiomes are unique to each person – a kind of microbial fingerprint. Modern diets with high sugar content and processed foods, along with increased antibiotic use, have been shown to be detrimental to gut microbiota, which, conversely, can be improved through diets that feed the microorganisms that keep our guts healthy.

The realisation that when I eat I am not actually directly feeding myself but a diverse community of microorganisms upon which I depend for my health, has drastically changed my perception of how my interventions as a greenkeeper can have a similar effect on the soils over which I have temporary stewardship. Every action, feeding soil bacteria and fungi with composts or manures, to aeration and careful timing of

mowing, has the capacity to enhance or diminish soil life.

This new understanding has been mirrored in the scientific community. Until very recently, the mainstream understanding of food and greenkeeping has been through the lenses of reductionist chemistry and engineering, while biology has been largely sidelined or ignored. The popularised 'microbe revolution' and increased scientific research in microbiology has put the spotlight on linking an understanding of the human biome with the microbial life in soil. However, as with all scientific advances, there are different ways of interpreting and using this knowledge for both the good and ill health of the planet. If we consider the 'nature as teacher route' when feeding the soil with compost, we literally feed it with living food that contains a whole range of bacteria and fungi. This starkly contrasts to the biotechnology route in which synthetically bred microbial solutions are being hailed as the manufactured probiotics of the plant world, which aim to increase chemical fertiliser uptake. Similarly, if we eat patented synthetically manufactured probiotics, we bypass the diversity and potency of eating living foods such as fermented foods. For example, it has been shown that one 16-ounce serving of sauerkraut is equal to eight bottles of high potency probiotics!

We need to be really open to all scientific and technological advances, yet remain extremely vigilant of the purposes they serve. There is huge potential for harnessing new knowledge in ways that can help us address the ecological crisis, yet there is also the danger of exploitation by vested interests, which view nature's capital as a resource to be exploited.

My personal soil challenge is to continue to explore how an understanding of soil, in all its extraordinary dimensions, can inform my future greenkeeping practices and deepen my relationship with soil in a way that increases its health. Every greenkeeping practice has an impact and every day, as a greenkeeper, I have the possibility of deepening my knowledge, perhaps simply by walking on the earth and learning through my feet. Through doing so I am increasing my intuitive understanding of the consequences of my actions on the green.

The good news is that we use, as our main base fertiliser a product that is composted turkey 'waste'. This product, known as Sustane, will given time, greatly enhance the microbiology in your green rootzone.

Enhanced micobiological rootzone will give better rooting, which in turn makes for a stronger grass plant. It will also help to establish fescues anmd bent grasses over the poas. And this in turn will reduce the need for as much irrigation; improve drastically the grass plants resistance to disesases; give a much 'tighter' sward which in turn will give a faster surface to bowl on.

This does take time unfortuneately. We do try to speed up the process by applying a cocktail of liquids every month and these do include natural products such as molasses, seaweed extractions, amino and humic acids and some micro applications of trace mineral elements.

At the end of each season we do overseed with the very latest Sports Turf Research Instiute rated grass varieties. These newer varieties will give enhanced performance in that they will have a longer growing season, better disease resitance, they are harder wearing, have an increased reaction to fertilisers, etc.. This does not mean that you will be able to bowl longer, but it does mean that your green may start to grow before it opens for bowling!

I have already discussed and planned what I will be doing to all of our greens at the end of the season, and typically it will take two days per green for me to caary out this schedule. This is a crucial time for me, and I do not want to waste it.

Going down this route is not the cheapest option at all. Typically we pay around £38 for a bag of Sustane delivered, and a similar bag of a chemical fertiliser would be around the £30 mark delivered. But I am convinced this is the way forward and a much more sustainable, excuse the pun, system of greenkeeping.

I enjoy the challenge that every green I look after throws me, and no two greens are exactly alike. That is the joy of my job!

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