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Down on the Farm ….What is EM?

Introduction

I have a kid here with a grin as big as the town hall. Middle son has just come home with the news that he has won the pumpkin growing competition. Our local school believes quite strongly in a diverse syllabus and part of the variety is a grounding in horticulture. (It's amazing how much easier it is to get kids to eat the silverbeet if they grew it!) Anyway, so that their skills would not be forgotten over the summer holidays or limited just to the school vege garden, pupils were invited to grow pumpkins at home. The seeds were supplied and the kids encouraged to: "get out there and grow it!" Now these aren't just ordinary pumpkins, but a giant variety suitable for Cinderella's carriage sort of thing.

Well I have to confess… I did not do the great parental assistance and encouragement bit. I was just too busy at the time and told them as much. "You want to grow a pumpkin, fine, you look after it."

And they did. All through summer and into autumn. And the end result weighed in at an impressive 48.6 kilos. Which is heavier than the two youngest gardeners put together!

We were a bit lucky. The day of the grand weigh-in, a digger happened to arrive for a bit of dam cleaning and drain digging on the farm. Well he was quickly hijacked off more important tasks and ordered to the vege garden so we could roll the bloody vegetable into his bucket and he could carefully deposit it in the trailer for the trip to school. No one thought to grow carry handles on the thing and it was downright awkward to move around.

But how did my neglected boys and their rather erratic watering programme come up with such impressive results, a good eight kilos clear of the nearest rival?
I cannot put it down to initial soil fertility. The garden had been grown on for several years and abandoned to weeds for a couple of years after that. I had neither manured nor cultivated it for a considerable time. Water may have something to do with it. The season was sprinkled with reasonably regular rainstorms. And sudden bursts of enthusiasm from the youngest gardener meant the plant probably never went thirsty for too long.

But I suspect our success, (sorry… their success), had something to do with underground effective microorganisms.

Back at the beginning of the story, I saw my gallant gardeners sweating buckets trying to weed the patch. It was obviously beyond them and I knew darn well I didn't want to get sucked into such a time consuming task. So I said, hey look, why don't we just mulch all those weeds down. Don't pull em out and throw them away, we will just bury the whole lot under a bale of old hay and several layers of newspaper.

Which we did. And then I suggested chucking on some EM. (Effective microorganisms). I had been given a bottle by a local organic farmer to have a play with, and this seemed the perfect opportunity to try it out with only the kids watching. So I mixed some of the EM up with a bit of molasses and water, sprinkled it over the mulch and got the guys to water it in well. End of Mum's involvement.

What a result!
So what is this EM? And what has it to do with farming?

Well in the past I have sometimes talked about rearing calves and the importance of getting good bacteria working in the calf's gut to help with the digestive processes. And we have talked about how a dose of antibiotics can wipe out these good bacteria indiscriminantly along with the ones that are causing any infection. But without good digestive bacteria a calf (or a person on antibiotics) can end up with poor digestion or thrush. The easiest solution is to get the good bacteria back as quickly as possible. One way to do that is to dose up on natural yoghurt which contains the acidophilus, lactobacillus bifidus and L.caseii (amongst others) that help our guts do what they are meant to.

Well a living soil is a bit like a great big intestine. That is where the planet absorbs its nutrients. That is where organic matter, timber, leaves, dead animals, last years second biggest giant pumpkins etc etc are digested and converted into other organic forms and minerals for other plants and animals to benefit from.

The soil is not just an inert medium that plants happen to be anchored in. A healthy vibrant soil contains more weight of life in microorganisms, worms, bacteria, bugs, beetles, actinomycetes and the like than is running around on top of it!

But of course not all the soil circus is working in our best interests just as not all the bacteria that get into our gut are good for us. There are some downright nasty bacteria, viruses and fungi that make life difficult. But if there are enough of the good ones, our intestines tend to stay healthy. Likewise enough beneficial bacteria in the soil will benefit the soil processes and plant life.

This is what led Professor Dr. Teruo Higa, of the University of the Ryukyus in Okinawa, Japan, to sort out some of the more beneficial varieties and apply them directly to soils. The results were remarkable and led to the development of technology now known as Effective Microorganisms (EM).

The mainstays of EM are the photosynthetic bacteria (Rhodopseudomonas spp), lactic acid bacteria, (Lactobacillus spp) and yeasts (Saccharomyces spp).

As we know, agricultural production begins with photosynthesis. The conversion of solar energy into chemical form. It's an amazing process, but not a particularly efficient one. Even rapid growing plants like corn and sugar cane only fix about six to seven percent of the sun's energy and that is maximum. One way to increase the amount of energy fixed, is with photosynthetic bacteria and algae. These utilize wavelengths that green plants do not.

Photosynthetic or phototropic bacteria are independent self-supporting microbes. They use the energy of sunlight and soil heat to convert secretions from plant roots, organic matter and harmful gases into plant useful substances like amino acids, nucleic acids, sugars and other metabolites. These can all be absorbed directly into plants to promote plant growth and also increase other beneficial microorganisms. For example VAM fungi increase in the root zone in the presence of amino acids secreted by these bacteria. In turn the VAM fungi improve the plant's absorption of soil phosphates. The VAM can live alongside Azotobacter and Rhizobium and increase the capacity of plants to fix Nitrogen.

EM also includes lactic acid bacteria. These produce lactic acid from the sugars and carbohydrates the photosynthetic bacteria and yeasts produce. This is a strong sterilizing compound and can suppress some disease inducing microorganisms and

nematode populations. It also contributes to the fermentation and breakdown of the tough cellulose and lignin. Here's our soil digestive processes getting a help along.

The yeasts in EM have other uses. They produce hormones and enzymes that promote plant cell and root division. They use the amino acids and sugars secreted by the photosynthetic bacteria and plant roots and in turn give off substances which are good growing compounds for the Lactic acid bacteria.

So all three species have a separate role to play, and help each other. They also have a symbiotic or mutually beneficial relationship with the roots of plants. So plants grow exceptionally well in soils dominated by these Effective Microorganisms. Thus my boys grin as big as a giant pumpkin.

EM is being manufactured at cost in over 20(45) countries in the world now. Only local organisms are cultured in each country and there is no genetic modification involved. It comes as a yellow-brown liquid. It smells quite pleasant. Sort of a yoghurty combined with molasses type of smell. And I believe it has a sweet sour taste though I haven't actually tried it myself.

It has pH of (less than) around 3.5. It can be diluted and applied direct to soils, or in weaker concentrations as a foliar spray on plants. Added to compost it will help ferment the organic matter, which in turn can be made into a liquid tea to help these good microorganisms get established throughout the soil.

Some of you might consider it with the same sort of suspicion you would normally save for hair-tonic salesmen. But I believe it's a lot more scientific than that. Look at home wine-making! If you pile a heap of lovely fruit in a container for long enough, eventually it will ferment into something. It might not be drinkable but it will have fermented.

Likewise with the soil. There are a huge variety of microbes and soil animals that could come into your land. The trick is to encourage the good ones. Just as you might try to seed the gut of a crook calf with good gut bacteria in a dose of yoghurt. Why shouldn't we do the same with the soil and the bacteria found in it. That is where EM technology comes in. It aims to seed the land with beneficial organisms, just as you would select the correct yeast to brew your wine.

A calf is not going to need to be dosed with yoghurt forever. So long as we feed the calf correctly those initial bacteria will multiply and carry on the good work for us. Same with the soil! Over time and under the right management the good microorganisms in soils will become self-propagating. Depending on conditions on the farm or in the garden, less and less EM will need to be applied.

Because never forget the awesome reproductive ability of bacteria.
Any of you who have seen clostridium bacteria at work as Blackleg in cattle will realize how rapidly they can reproduce and respond to a change in circumstance. A healthy animal one day, with a small bruise, could be dead, swollen and bloated beyond recognition 24 hours later just from the incredible multiplication the bacteria are capable of. A single-celled bacteria can produce 32 million offspring in one day! Compare that with the reproductive rate of the livestock above ground and you start to understand why just a sprinkling of bacteria can be so significant.

Bacteria and microbes live, reproduce and die, at enormous rates and in doing so release a constant stream of nutrients in plant available form. They collect nitrogen and other nutrients from the soil organic matter and mineral particles. They reproduce, so

more microbes are collecting and converting nutrients. They die and release what they have collected in a form the plants can use. The plants grow better, assimilate more energy and provide more food for more microbes and so it goes on.

It's a two way process. Living plants absorb energy from the sun, incorporate it with carbon dioxide from the atmosphere, water and nutrients they require from the soil. Then they release oxygen back to the atmosphere and carbon to the soil as carbohydrates, glucose and other carbon forms for the microbes to feed on. The size of this microbial population is governed by the inputs from the plants, the primary producers.

We can see the grass and trees growing on top of the ground. But scientists tell us that fifty percent of a plant's primary production disappears underground to establish the root network and feed the microorganisms. That is what happens in a healthy natural system. It is a mutually beneficial relationship that has evolved over eons and led to the formation of our most fertile and well structured soils. Even the timing is perfect. In most natural systems, the greatest microbial turnover and release of nutrients, coincides with the plant's growth and its seasonal needs.

Understanding this helps us see the danger of farming systems and landuse activities that starve the soil of carbon matter. No carbon means no food for the microbes. No food for the microbes means no turnover of nutrients. No nutrients means no plant growth which means no carbon inputs and so it goes on into a downward spiral with loss of fertility, loss of structure, erosion and so on and on.

So our effective microorganisms are only going to remain effective if we manage our pastures with them in mind too. That means not overstocking or baring paddocks. It means allowing pastures to develop enough leaf to do their photosynthesis number effectively and fix some carbon for all the other little greeblies further along the food chain. So a decent rest between grazings.

EM has been subject to a variety of trials within New Zealand on everything from sheep and cattle farms to onion growing. Generally it has been shown to have a reviving action on growing systems. It can improve soil quality, soil health, and the growth, yield and quality of crops. It helps in the decomposition of organic matter and during fermentation produces several normally unavailable organic acids; lactic acid, acetic acid, amino acid, malic acid and various other bioactive substances and vitamins. It has an antioxidant effect, which improves the immune system of both plants and animals.

The technology is well established overseas. It is used on everything from market garden soils and foliar feeding of plants as well as composting material before it is returned to the soil. Fish farms in Thailand use EM to keep the ponds healthy and reduce the need for antibiotics. Municipal authorities spray it over rubbish dumps to help in the breakdown of dumped matter, to reduce smell and the incidence of disease causing organisms.

(Kyusei) The New Zealand Nature Farming Society set up the production process here in Christchurch. This is a non-profit making group committed to making EM cultures available as cheaply as possible so that cost is not a barrier to their use. The group's aims are:

- To promote the production of safe and nutritious food to enhance human health.
- The development of economic and spiritual benefits to both producers (farmers) and consumers.
- Sustainability and ease of practice by every person.

- Conservation of the environment.
- Production of sufficient food of high quality for the increasing population.

I'll certainly be trying the stuff out on the paddocks this year. But I can see we will have to watch we don't chew our paddocks out hard too often. Got to start thinking about all those little microorganisms…
Got to go find some pumpkin recipes.