”DOWN ON THE FARM”, A SERIES OF ARTICLES BY NEW ZEALAND AUTHOR, TRISH FISH, 2004.

PART ONE.

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 indiscriminately 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 land use 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.

The New Zealand Nature Farming Society (Kyusei) 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.

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PART TWO.

Down on the farm… What is EM?

Thailand Experience

Ding ding. Its time to wake up out here. Time to stir ourselves out of our rural lethargy. Time to see what is really going on in the wider world. See what the planet needs and what sort of product our markets really want. And above all see how our tiny population has let us get the idea our normal farming practices are good ones, or even the best in the world and that we can carry on this way forever.

Get over it.

I had a real wake up recently when I visited Thailand for a workshop on EM technology and its use in natural farming systems. Thailand, the “kitchen of the world” with 68 million of its own people to feed and it still has plenty to export. There were nine countries represented at the workshop. In my ignorance, I would have believed many of them inferior to New Zealand in agricultural expertise. But I soon realised we have no room and no reason for our smugness. In fact when it comes to natural farming systems, and giving markets the naturally grown and balanced food they seek, well…we are dragging our heels and still stuck in systems that are polluting our waterways and degrading our soils. The only reason we have got away with it so long, is our low population. These heavily populated nations have had to wake up sooner.

EM workshops are held every six months with about 40 delegates from around the world. This time people came from Sri Lanka, India, Nepal, Malaysia, Singapore, Phillipines, Myanmar, Laos, Thailand, Japan and three of us were kiwis. Most of the other country representatives were from industry, government departments, agricultural consultants, township “managers” and the like. We kiwis were just there under our own steam as curious individuals. I couldn’t help but wonder when officials from New Zealand might wake up to the changing world. They just might have to run to catch the boat.

Because it’s a trip not to be missed…city and home waste management, water and soil pollution control, animal health and disease management, improving agricultural yields and food value, sustainable farming systems and so on.

Admittedly some of these countries have way bigger problems than we have to deal with, but that is by good luck and virtue of our small population rather than good management. These other countries have had the alarm bells ringing about soil and water health for a while now, and certainly some of them have some big messes to clean up. Now they are doing their homework.

But if we in New Zealand want to boast of our green, clean farming industry then we should be leading the way in natural sustainable agriculture. With trumpets blaring. Afterall that is what our markets want. No one is asking us for nutritionally challenged produce grown in unbalanced soils. No one is even asking for genetically modified produce. The purchasing public wants healthy and healthily grown crops and animals. We have unique advantages: a highly professional and competent rural sector, world leading research organisations and splendid physical isolation. We should be leading the world in this field, not ignoring it.

But the reality is, organic farmers here are still considered greenies and fringe farmers. Our government farm advisors are educated in a system where research is funded by industry with more interest in what it can sell than in promoting sustainable systems.

Wake up guys. We are getting left behind. The land of the sheep is looking pretty sheepish to the sharp and critical world outside. We are not the agricultural gurus and heroes that I imagined us to be.

My time in Thailand was a mix of being heartened by the great work going on around the world and growing unease about our place in the race. Problems we are only just coming to realise, like our polluted lakes and overburdened rubbish tips are old news to these nations with big populations. And already they are working out how to deal with them, while we are just waking up to the fact that we might have a problem. Heck, I live

in deep rural Far North. Pristine countryside, yet our Lake Omapere contains such high levels of cyanobacteria that it is not only unsafe for human and animal consumption but in fact we are advised to not even come in contact with the water. That water flows down the Utakura River into Hokianga Harbour. My harbour! Where my kids like to fish and swim. But now we are advised not to. Yet within living memory the lake was once crystal clear and an ideal source of water for Kaikohe township. There is no human sewage to be blamed, it is only the farmland that feeds into the lake catchment…

And what of our rubbish tips. We struggle to deal effectively with the refuse of four million people. Imagine the mess we would have with a population like Thailand, 68 million. There is no room for complacency.

Wake up time people.

Overseas, work has been underway for years cleaning up rivers, lakes and canals, and toxic soils using EM technology. The people behind it are not “greenies” but are microbiologists, soil scientists, biochemists and the like. Many of them have government or local body funding. They are not part of a system trying to show returns for shareholders. They are just trying to clean up the messes.

Over the next couple of months I hope to share with you the practical lessons I learned in Thailand. Some can be applied in small home scale operations, some have application at industry and government levels.

The workshop was essentially practical, hands dirty sort of stuff. While at times I felt I had been dropped into the script for a Peter Sellers type movie with the varieties of English as she is spoke, over the days I came to respect the knowledge, professionalism and dedication of the organisers and other delegates. I have spoken of EM before but just to recap…EM stands for Effective Microorganisms. It is a mixed culture of naturally occuring microorganisms; phototropic bacteria (these ones can fix the suns energy into useful acids, sugars and metabolites), lactic acid bacteria (which help suppress some disease inducing microorganisms and soil pest populations) and yeasts (which promote cell and root division). The three each have a separate role to play in soil health but help each other and have a mutually beneficial relationship with plant roots.

So is EM just the latest buzzword? Are the proponents just zealots who think their way is the only way? Possibly yes, to both questions. But a couple of factors make this technology worth a lasting look.

Firstly, the scientific basis behind the work is straightforward. The presence of a vibrant soil microbiology does affect soil fertility and the health of plants and animals growing on it. Any soil

scientist will tell you that, and any organic farmer knows his livelihood depends on it.The organisms that eventually got selected for EM and are now cultured in different forms around the world, are ones that have proven to be the best combinations.

Secondly, the infrastructure behind the EM “barrow” if you like to call it that is unusual in a competitive modern world. There are three sides to it. The first is the Sekai Kyusei Kyo organisation. This is a spiritual and religious group. Hah! You thought there was a catch? But nothing to fear here. Kyusei literally means to “Save the World” and the group sees nature farming as a practical way to do it. They encourage production of nutritious food to enhance human health and well being, sufficient production to feed the increasing population in a sustainable way, and conservation of the environment. No sermons. They are just getting on with the work.

Secondly is APNAN (the Asia Pacific Natural Agriculture Network), which promotes this nature farming and EM technology to the world through practical demonstrations and workshops like the one I attended.

And thirdly, there are the research arms; the EMRO (Effective Microorganism Research Organisation) and INFRC (International Nature Farming Research Centre) which both research nature farming systems and EM applications for everything from agriculture to water treatment, waste management and aquaculture.

The three organisations work “symbiotically” all with ideals based on sustainable societies, preserving the environment and uplifting welfare of both farmers and consumers. They are basically non-profit groups, with any monies made ploughed back into the network for more research or more education.

Where EM is cultured in different countries out of local organisms, it is grown and sold at cost to make it as affordable as possible. These people sincerely want to heal the world and convert degraded soils into productive ones rich in useful microorganisms. That’s cute sure, but the yields being attained, the animal health statistics and just the feel of the huge and impressive operation being run at the Saraburi Centre in Thailand really made me take note. Healthy fattener pigs. No smell! Broiler chickens, ready for market in eight to ten weeks, no smell! Prawns and catfish farmed intensively in ponds. No need for a water change until harvest, no smell. Kitchen waste from the centre hostel, converted to fermented pulp and ready to apply to the gardens within a week. That is even faster than composting. Impressive rice yields, a commercial orchard that has used only EM for over a decade producing fruit with flavours the way it should be and yields above the neighbouring properties where chemical fertilizers are used. And the taste! You think you like mango…well an organic mango grown with EM is worth a trip to Thailand all on its own!

Over the next couple of months I’ll look at how to get EM in New Zealand, how to extend it and how to use it.

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PART THREE.

Down on the farm… What is EM?

How to use it, How to expand it, EM use on the farm, pastures, animals

Last month I gave us a bit of a rev up about our need to get a bit more environmental in our farming approach. This month I want to share some of the practical applications I learned at Saraburi in Thailand. Firstly, why do we need to get EM? What is the advantage? Do we need it at all?

Perhaps the simplest way to explain it is to compare it with winemaking. Any of you who brew your own wine or beer will understand the importance of putting the right yeast in when getting a brew started. Once it is there, that good yeast will multiply merrily and produce a nice tasting drop.

A load of grapes or blackberries will ferment just fine even if you don't add the good yeast to start with. There are plenty of wild yeasts in the air and on the fruit to start the process. After all it is part of the natural cycle of decay. But while they might ferment and produce bubbles and even alcohol, there is no guarantee the stuff will be drinkable. I once tasted wine that an experienced wine maker gave me as an example of "mouse" flavours from the wrong yeast getting hold. Talk about stale cat breath! It tasted just like I imagine a slightly desiccated dead mouse would.

Yet the same fruit fermented with the correct wine yeast tasted exquisite. The same goes for our soils. Put a heap of organic matter down, and it will decay all right. But some of the agents of decomposition will be nasty beggars and decay could be by putrefaction resulting in a stinking mess. By seeding the soils or organic matter with EM before applying it to the soils, we are putting in some of the good guys: health giving lactic acid bacteria suppress harmful micro-organisms and help break down the tough stuff like lignin and cellulose. They can reduce nematode populations and disease inducing fusarium. The right yeasts produce bioactive substances, hormones, and enzymes that are useful to plants and promote cell and root division. The photosynthetic bacteria in EM produce amino acids, which increase the amount of mycorrizhae around the plant roots, which in turn improves the plant's uptake of phosphorous. They also improve the plant's ability to fix nitrogen from the atmosphere.

So it sounds good. But how do we get hold of the stuff. Well EM was originally developed in Japan in the 1980's under Professor Dr Teruo Higa. It is now cultured in over 45 countries around the world. And fortunately for us in Godzone, we have a production unit and distribution base here in Christchurch. EM can be ordered in one to twenty litre multiples.

The costs are based on its production. Currently that is about $15 a litre. Less for bulk orders. Don't go thinking you are supporting just another capitalistic venture trying to milk money from the organic minded. The Christchurch unit is audited and run purely at cost with its manager Mike Daly putting in a fair proportion of his time for free. The EM you buy just helps him to produce a bit more and continue getting the word out there. One of the advantages of EM is that the little bit you buy can be extended. Massively. But remember we are dealing with living organisms here. It is not some chemical. It is alive and must be treated with the appropriate care. So correct storage is important. The EM concentrate is in an inert state. It will be in a sealed container and stored anaerobically. That means no oxygen. It also doesn't want to overheat or get blasted with sunshine,

which the photosynthetic bacteria will like and be activated by. So keep your EM container closed and in a coolish place out of direct sunlight.

The EM concentrate will keep for about a year from its date of manufacture. Of course it will not suddenly be no good once the use-by date has gone, but that is the recommended shelf life.

Once you have extended your EM, it is called Activated EM. It's recommended shelf life is much shorter, only about a week. So plan how you are going to use the stuff and have any materials you might need organised before you "activate" it in the first place.

Extending or activating EM is relatively simple. We are just going to wake it up with a good feed. Firstly you need a decent sized drum. A plastic or stainless steel 200 litre drum is ideal. I used a steel one that had a previous life as a bulk molasses container. It worked fine. If 200 litres is too much or too hard to handle go for 100 litres or even just twenty litres. But the drum needs to be air tight, clean and free of chemical residues. You will need molasses. Make sure it is good thick heavy stuff with a specific gravity of at least 1.35 kg per litre. If it is less than that and watery, you will have to judge it for yourself a bit and add more to compensate.

Most animal feed stores, vet clinics and farm supply shops will have molasses in stock. But if you cannot get hold of any, then brown sugar is an acceptable alternative. All we want is a food source for our hungry EM's.

And you need clean water; preferably drinkable. But if you are on town supply and the water is chlorinated then you need to either filter it or store the water for about three days with the lid off to allow the chlorine to dissipate. You can speed the process up by pumping air through the water for half a day or so.

For a 100 litre drum mix up five litres of molasses in 90 litres of warm water. Once the molasses is well and truly dissolved, add five litres of EM concentrate. If you can keep the brew warm then so much the better. I wrapped my drum in an old electric blanket and a couple of old sleeping bags, which kept it snugly at about blood temperature. Some farmers use a fish tank heater submerged in the brew. Heat is not essential, but it speeds up the process.

The solution is ready to use when the pH drops below 3.5. It should have a sweet sour sort of smell. If the pH wont come down or it smells bad, then somehow you have got the wrong bugs in your brew and don't use it. I got a dinky little pH meter from Dick Smith. It wasn't cheap ($130) but my highschool memories of litmus paper etc were too rusty to rely on.

To avoid contamination, keep the area you mix in clean and tidy, wipe up any spills. Store your extended solution the same as you would the concentrate. Keep it airtight (but ease the lid after a few days in case there has been any gas build up). And keep it out of the sunlight.

So now you've got some… what are you going to do with it?

Well the most obvious one for pastoral farmers is…get it on the pasture. Spray or dribble the stuff out on a soft sort of day when it might get washed in with a bit of drizzle or light rain. Put it on paddocks with either a bit of length to them or, put it on after topping or mowing when there is a bit of organic residue for the bugs to get started on. How much to apply? Well remember that you are not applying nutrients, where more is better. But you are applying a living population, that given the right conditions will multiply of its own accord. Now bacteria are perfectly capable of multiplying at exponential rates. In fact one study I read suggested if conditions were perfect and self limiting factors were negated, an enterprising bacteria could produce enough offspring to outweigh the world in a matter of a week or so.

Of course our EMs are not likely to find conditions in the front paddock to match the laboratory, but they should reproduce quite merrily. (Providing they don't get washed out in torrential floods first and so long as

the sheep and cattle haven't grazed your land so bare there is nothing left for them to live on). How often you apply it will depend on your finances and work schedule. But ideally one would start in spring and repeat sprayings every couple of months until late autumn or until the risk of fungal pasture diseases pass.

Besides applying the activated solution to pasture, you can use it around the farm in a variety of ways. In the chook house use a bit of EM to ferment a portion of their feed (chooks will go crazy for it). Spray a diluted solution around the hen house and floor. It reduces harmful bacteria, cuts the bad smells and keeps the chooks healthy. It is reputed to reduce mites, lice and harmful insects and lowers the need for antibiotics and disinfectants. The recommended dilution is between one and five litres of your activated solution to 100 litres of water. The worse the smell, the stronger solution you need. Bad smell is simply the ammonia and hydrogen sulphide given off by the undesirable microbes attacking the animal manure. Replace them with beneficial bacteria and the smell goes. Believe me. I walked through the piggery at Saraburi and inspite of 40 degree heat those pigs were just clean and happy and there was no odour whatsoever from them or their housing. Whereas in New Zealand nobody wants a piggery within cooee as a neighbour because they know it will be a big stink with major effluent problems. But at Saraburi, the pig effluent was piped into a huge pond where it fed carp and catfish. That's right, it is healthy enough to be used as a food source. And the lake smelt fine as well.

Back home well…begin by spraying the hen house out about once a week. As the odour decreases you can reduce the frequency.

I will be trying the stuff in the calf pens, in the chook house, around the dog kennels …my partners gumboots…the possibilities are endless.

Its also been trialled as an addition to stock drinking water at rates of about one litre to 5000 litres. It can be added to septic tanks, to stock bedding and believe it or not helps in farm cement too. The concrete around dairy sheds, pig sheds and calf pens gets eaten away as a result of the urine and the bacteria that feed on it. Well EM can protect your concrete! Mix one percent of extended EM in the cement water next time you are mixing concrete for use around the farm.

And its use is not limited to outside. Try EM around the home to reduce dust mites, mould and harmful bacteria. Use a dilute solution, about one to one thousand for spraying on the carpet, the curtains, on tube lights and the like where dust accumulates. In the toilet, shove a gloop down at regular intervals. Both the drains and the septic tank will benefit. Likewise in the kitchen, laundry and washing machine. Use a dilute solution for cleaning the bath.

That is some of the practical applications for your extended solution as a liquid. Next month I want to look at how EM can also be applied with organic matter in the garden, on the farm and as an environmental tool. As I said last month, a lot of countries in the world have worse problems than us to clean up, and they have already worked out practical ways of doing so. EM is an important part of the answer.

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PART FOUR.

Down on the farm… What is EM?

Bokashi and Mud balls!, and recycling food waste

The idea of seeding matter with desirable bacteria to give us the product we want is nothing new. We do it commercially all the time. We do it in the home and even on the farm. Successful silage making is dependent on getting the right "starters". Wine makers seed pulp with their chosen yeast to get a good tipple and your home yoghurt maker relies on carefully selected bacteria.

That is the principle behind EM (Effective Microorganisms) technology as well. From a practical point of view there are several ways we can go about it, on the farm, in the garden or orchard. Last month I looked at how to extend concentrated EM and how the resultant liquid could be used.

This month, let us go a step further and see how we can mix EM liquid with organic matter and apply a bulk of fermenting nutrients to our land. The combination will have an even greater positive effect on our soils.

Bokashi (pronounced pickaashee) is like a super fast super charged compost. This can be made using the organic materials we have on hand. In Thailand the most widely available drymatter is rice husk and rice bran. During the workshop we mixed these two with a portion of chicken dung and dampened it all with extended EM. We mixed all the ingredients by hand and shovel on a clean concrete floor and built tidy little heaps about a metre square and 200mm high. These were then covered in jute sacks. All this work and all in 40 degrees C heat. Boy did we sweat! But if we thought we were getting hot, then so was the heap. Within 12 hours it was almost painful to touch and needed stirring to bring the temperature down to the ideal 25 to 35 degree C. More work! It soon showed the unfit office wallahs from the "poor farmers" amongst the conference delegates. The trickiest part was getting the right degree of dampness with the extended EM solution. The ideal is a mix that holds together when squeezed in a ball but does not ooze excess moisture.

Within seven days the Bokashi would be ready to use. The microorganisms having moved throughout and attached themselves to the material. This was aerobic bokashi. The organisms used oxygen in their activities, so the heap heated up.

But we also made Bokashi anaerobically. The mixture was the same, but this time we pressed it tightly into a sealed drum so that air was excluded. This prevented any heat developing, so less energy was lost during the fermentation process making the result a richer fertilizer.

Obviously in New Zealand we don't have a lot of rice husks. And a tidy little heap a metre square isn't going to help much on a thousand-acre farm. But we do have bulk sawdust, hay and straw, surplus grass at some times of the year, and we have silage cutters and wagons. Many farms have loaders on their tractors that could be put to mixing up truckloads of ingredients. We also have animal manures and fresh cut pasture for the nitrogen component needed. In fact for anyone operating a feed pad through winter, then disposing of the manure becomes a problem. Here that problem becomes a solution… For instance in Myanmar, Bokashi is made using ten parts of straw, to three parts of any type of animal manure and one part of bran. (As well as the added EM and molasses.)

Firstly they soak the straw in the EM solution. (Made of 1:1:100 of EM concentrate, Molasses and water). Then put down a layer of straw, sprinkle on some of the bran and some animal manure, spread another layer of straw on top and repeat the layers until the heap is about 80 to 100 cm high. Then it is covered with sacks or a polythene sheet to stop the mix drying out too much. after a week the bokashi should have a sweet fermented smell and white fungi will appear throughout it. Then it is ready to use. It can be dug into the garden, spread on the pasture or piled under fruit trees…

Look on Bokashi as a busload of visitors coming to help on your farm but who bring their own food with them. Microscopic workers of course, but millions of them. Of course microbes with a food source will stay a lot longer than those just sprayed on in liquid. They can get better established and last longer both on the ground and in storage.

At Saraburi in Thailand, bulk bokashi is made in massive great hoppers and mixing machines. It is like a factory operation, with hundreds of bags produced whenever there is sufficient rice husk and chicken dung ingredients to make a run worthwhile. The bags can then be used around the demonstration farm as needed, or sold at cost to local farmers who want to use EM technology.

Besides using bokashi directly there are two more applications, which really interest me. Refuse and water pollution. Rubbish disposal is a problem everywhere in the world. Getting rid of our mess seems to get more and more complicated even with our tiny population. And the speed at which we fill our dumps and the difficulty of finding sites for new ones means anything that will reduce the flow of garbage to the tip is exciting.

EM research has found that household scraps, fruit and vegetable peelings, waste veges and the like fermented with bokashi, can be ready to add to the soil within a matter of days. This is a distinct advantage over composting. In reality, many home composting systems tend to just be a heap of garden and kitchen stuff that is left to rot in its own good time. Poor compost making can smell bad and attract rats and the like. And it is more likely to be months rather than weeks, before it makes a safe and valuable addition to the garden.

So the EM research people came up with a little kitchen garbage disposal unit. It consists of one bucket with holes in it, inside a larger kitchen tidy type of unit with a tap at the bottom. Every day you add your peelings and treasures from the back of the fridge, sprinkle a handful of bokashi on the top, press it all down, seal the lid again and leave it to ferment a bit longer. After a few days a liquid juice can be drawn off the tap at the bottom. This stuff is rich in nitrogen and can be used as a plant food in its own right, but carefully, as it is unbalanced nutrient and if used too richly can make plants disease prone. However the remaining bits and pieces in the bucket make a rich fertilizer. They don't pong. Well they do, but it is a sort of fermented fruit type of smell, not a rotten smell at all. They are covered in microorganisms and can safely be buried in the garden. Then by the time the roots of any crop that is transplanted on top of them, reach the mix it will have been converted into a rich mix of nutrients. The wider the variety of scraps involved, the more balanced the nutrients will be.

For those who want to keep the unit handy in the kitchen make your Bokashi without animal dung. Stick to sawdust and bran. For every kilo of garbage, add about 50 grams of bokashi. Press it down firmly and close the lid tightly to keep it anaerobic. Draw the fermented juice off daily. Mix it with water at 1ml to 500ml as a plant food. Add it to your septic tank, pour it down the drains to stop them clogging. The juice is rich in lactic acid bacteria and yeasts, which will work on any sludge in your pipes or septic system. Don't add cigarette butts, already rotten garbage or large chunks of meat or fish.

The fermented garbage can even be buried in a planter. First put down a layer of gravel for drainage. (Note the planter must have a drain hole.) Then add a layer of fermented garbage, up to a quarter of the depth of the planter, then fill it with soil. Cover it with plastic and allow it to ferment for ten days or so. You will probably get a lovely crop of white mould under the plastic. That's fine, but don't put your plants in until the mould stage of

fermentation has passed or your seedlings will end up as just so much more bokashi. Usually after a month the planter is ready to go and your plants will thrive in it.

Besides fertilizing hungry soils, bokashi can be used environmentally…as a cleanup solution for polluted waterways, smelly effluent ponds, farm drains and dams. Considerable work has been done in Japan and Thailand applying balls made from bokashi and mud into the sludge of canals and waterways. Not only is the depth of sludge radically reduced but the smell and water clarity improve out of sight. This is really exciting stuff. It seems the mix of beneficial bacteria combat the harmful bacteria, which produce rotten and sulphide smells and go to work on the sludge layers breaking them down.

Forming bokashi into heavy balls enables the EM's to sink down through the water and get deep into the sludge at the bottom. Then as they proliferate outwards, they attack the pollution in their area. EM liquid can also be applied to the surface of still bodies of water. The combined approach of regular applications of EM liquid and bokashi mudballs seems to be the most effective. I will certainly be trying some on our dams and will see if the neighbour wants to try some in the cowshed settlement ponds. What a breakthrough if we can reduce the effluent that ends up in our waterways, and improve the quality of our stock water supplies.

To make mudballs simply mix up about ten litres of soil, a litre of bokashi, and a litre of activated EM solution. Grab a generous handfull of the mix and press it tightly into a ball shape. At Saraburi the balls were further compressed with a small mould which squeezed out excess air and made the balls a uniform shape and hard enough to survive being dropped into water.

After a week the new balls will probably be covered with white fungi. As soon as that has disappeared they are ready to use. Drop the balls into the waterway at about one to ten balls per cubic metre of water (depending on the pollution level) monthly or until the pollution is cleared. The mudballs can be used where water is flowing and EM liquid can be poured into areas where the water is still. To combat sludge dilute your activated EM about ten times, and add 30 litres of that diluted mix per metre of sludge once a month.

So here we have a solution to our polluted lakes and putrid waterways. Get the millions of little microbes going to work for us. Twenty-four hours a day, no strikes, no overtime, just busily converting degraded ecosystems full of harmful microbes into productive ones with beneficial bacteria. If it can work overseas, it can work for us too. We just have to get out there and try it.