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EFFECTIVE MICROORGANISMS

What is EM?

"EM" stands for effective microorganisms. EM is a unique microbial technology developed by Dr. Teruo Higa from Japan in the 1980's. This technology has gained rapid recognition and use around the globe and is now used in more than 140 Countries around the globe and manufactured in more than 60 countries worldwide

What microbes are in EM?

EM consists of mixed cultures of beneficial and natural occurring microorganisms that can be applied as inoculants to increase the microbial diversity of soils and plants. EM contains four main families:

1. Lactic acid bacteria
2. Yeast
3. Photosynthetic bacteria
4. Actinomycetes and other types of microorganisms

Research has shown that the inoculation of EM cultures to the soil/plant ecosystem can improve soil quality, soil health, and the growth, yield, and quality of crops. Also when used in animal systems similar benefits have been shown. These microorganisms have a "reviving action" on growing systems and are completely safe to use.

- EM contains microbes that can enhance the natural fertilising processes within the soil, increasing the resident nitrogen fixation capacity directly through the stimulation of N fixing bacteria, and indirectly by increasing clover growth, increasing mycorrhizal activity and reducing the need for fertiliser inputs, whilst maintaining levels of production.
- EM will help the decomposition process of organic materials, and during fermentation will produce normally unavailable organic acids, such as lactic acid, acetic acid, amino acid, malic acid and bioactive substances and vitamins. A key ingredient in this process is organic matter which is supplied by pasture residuals, (dead matter) recycling crop residues, green manures and animal manure. In addition, this process leads to increased humus in the soil.
- Lactic acid bacteria which is a major ingredient in EM will suppress pathogenic microbes both directly, and indirectly, through the production of actinomycetes. EM produces an antioxidant effect which improves the immune system of plants and animals.
- EM used in waste management systems will improve the efficiency of biological systems, and in the process, reduce smell, reduce sludge, and compete against harmful pathogens in the effluent and application sites.

digestive system, improves feed conversion, enhances animal health, and reduces methane emissions from the dung.

Potential benefits of EM use on Dairy Farms

An integrated programme using EM on dairy farms has the potential to give significant improvements of environmental indicators. These include reduction in leachates to groundwater, reduction in greenhouse gases to atmosphere whilst maintaining levels of productivity.

Research both from overseas and NZ comparing EM in various applications related to dairying, and some related research on some of the individual micro-organisms that are contained in EM, demonstrate potential significant benefits in mitigating some of the negative impacts on the environment.

The areas that we can influence positively with EM are:

1. Reduction of fertiliser inputs whilst maintaining production levels
2. Reduction of nitrogen leaching and volatilisation
3. Reduction of methane and greenhouse gas emissions from the environment including animals.

The areas of application are:

1. To pasture and soil
2. In conjunction with fertiliser
3. addition silage
4. In the effluent pond

References and expected effects

Yield

With the addition of EM to the pasture we can expect an increase in yield (Daly & Stewart). This paper published in a refereed international journal showed that EM increased the yield of crops, and by assumption an increase grass growth could be expected with application of EM. This paper also gives the list of microbes contained in EM. A more description of the groupings of mcroorganisms and how they work is described in the reference “principle Microorganisms in EM technology and their action”, (2001).

Fertiliser addition

When EM is combined with a half rate of fertiliser, the production is similar to a full rate of fertiliser on its own (Sherchand, 2000). The EM contains phosphate solubilizing bacteria (PSB) this will mobilise P and enhance the breakdown of rock phosphate (Rai 2005). The Photosynthetic bacteria have a denitrifying characteristic (Rhodopsuedomonas sp.) so this is likely to lead to less Nitrogen being leached and lost in a pastoral system using EM.

Greenhouse gases

In Austria, trials at pilot scale were conducted to investigate the influence of EM addition to

Effluent Pond

A trial was conducted in NZ in 2003 and a series of Dairy Effluent ponds in Canterbury were dosed with EM and the effect measured (Walter & Karki, 2003). This pilot study demonstrated in the laboratory a reduction in odour and COD levels. In the field, a major improvement in pond maintenance was observed with the surface crusting that was common to ponds and a source of problems in terms of maintenance was completely broken down. Analysis of harmful microbes (E.coli Salmonella and coliforms) in the ponds through a sampling programme over the duration of the project was inconclusive due to the large variability of the results. However it was noted that in general the trend was for lower harmful bacterial presence in the EM treated ponds when the material treated with EM was incubated for 8 days.

For dairy farms that return their effluent to the pasture, then this is an excellent opportunity to get a double benefit from the EM;
1) The effluent becomes a carrier and a food source for the microbes and the target is the pasture and soil.
2) The EM will reduce the number of pathogenic microbes (E.coli, etc) in the effluent and make the pasture safer for animals grazing the pasture and staff applying the effluent. Although the results in the NZ trial were inconclusive in terms of reducing pathogens, there are numerous reports from overseas studies which show positive results in this area.
Work in the Netherlands has shown a reduction in greenhouse gases (methane, nitrous oxide, ammonia, total organic carbon from slurry stores (pig and dairy effluent) (Amon, et. al., 2004)

Animal Feeds

Bokashi is a fermented feed version of EM. This usually fed to the animals as a small part of there ration around (1-3%). Feed Bokashi has been used in many examples with poultry and pig farming in Asia with generally positive results.

In the Netherlands a study has shown that a potential for lower methane production from silage made with EM compared to control silage (report FIS 2003).

Therefore there is an expectation from this work that an animal performance increase could be expected along with environmental benefits by way of reduced methane production.

Cost of EM

EM applied at 20 litres per ha costs around $20 per ha. I would anticipate that around 100litres per ha per year would be optimum (5*20) that would cost $100 per ha.

There would be further applications to effluent pond, and possible silage or feed. These costs would have to be calculated after the system is assessed. However the overall cost is not likely to be high relative to the positive gains.

Approach

I recommend that a monitor farm is set-up, under a fully integrated EM programme. Together with a monitoring research programme to thoroughly measure environmental indicators and

References

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