Effective Microorganisms

How they Work and the Effects

emnz

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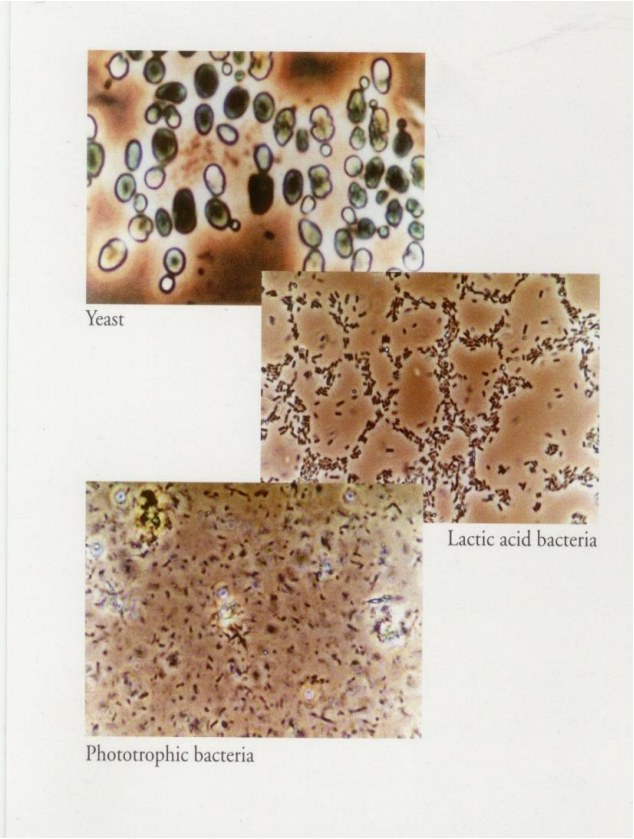
What is EM?

- EM is the unique composition of a diverse group of bacteria, yeasts and fungi (3 main family's, multiple species) which has been thoroughly tested and proven safe for human and animals. One of the strengths of EM is that it is a diverse combination of microbes, and this gives it versatility in terms of a wide scope of applications that it can be used on.
- EM is certified Organic with BioGro



Where did EM come from?

EM1 was developed in Japan more than 20 years ago by a Japanese Professor Prof Dr Teruo Higa. EM has spread extensively around the world and is now a global technology (150 countries). EM is made using the microbes present in the country of manufacture…the microbes are not imported. 4,000,000 tons of EM made globally in 2011 – 2012

How does EM work?

One of the strengths of EM is that it is a diverse combination of microbes, and this gives it versatility in terms of a wide scope of applications that it can be used on. EM was initially developed to improve soils and enhance crops but has evolved to benefit a wide range of areas.

The following pages detail the benefits of using EM and data showcasing this in local and overseas trials

Improve Soil Health and Performance

EM work by getting the natural processes to function, by stimulating biological activity in the soil. This will improve soil health and performance by enhancing the natural fertilising processes within the soil.

- EM will enhance growth and improve soil health through:
- Fixing atmospheric nitrogen
- Converting organic matter to plant nutrients
- Decomposing organic residues
- Recycling soil nutrients
- Breaking down fertiliser compounds
- Improving root structures
- Reducing compaction issues

Supporting Information

- Changes in the Soil Microflora Induced by EM
- EM for Sustainable Agriculture

Improved Soil Structure

EM is an advanced microbial inoculant with beneficial bacteria and fungi that jumpstarts and/or restores the beneficial biology leading to great soil structure. EM helps to build “Well-aggregated” soils through the introduction and stimulation of soil microbes. Microorganisms are the hidden magic that allow a healthy soil to flourish. Soil microorganisms produce many different kinds of organic compounds, some of which help to bind the aggregates together and improve the soil structure. In addition EM will breakdown organic matter to create humus and stimulate root growth further improving soil structure.

Example

The image illustrates a paddock trial which shows EMs ability to improve soil structure. The image shows the improved soil structure in the EM treated paddock with more fibrous roots and clover nodules another benefit.

Pasture Renovation

EM can enhance pasture renovation through breaking down old pasture residues creating food for the soil and enhancing soil biological activity.

It will also enhance germination of the new pasture and pasture persistence.

Example

The image to the right illustrates a paddock trial we ran with a farmer showing the effectiveness of EM in pasture renovation. The farmer used a double spray technique with roundup to kill old pasture and then direct drilled new pasture. EM was combined with the Roundup spray at 10 litres/ha. The farmer did one block with EM and one without and the below photos were taken 3 months after emergence.

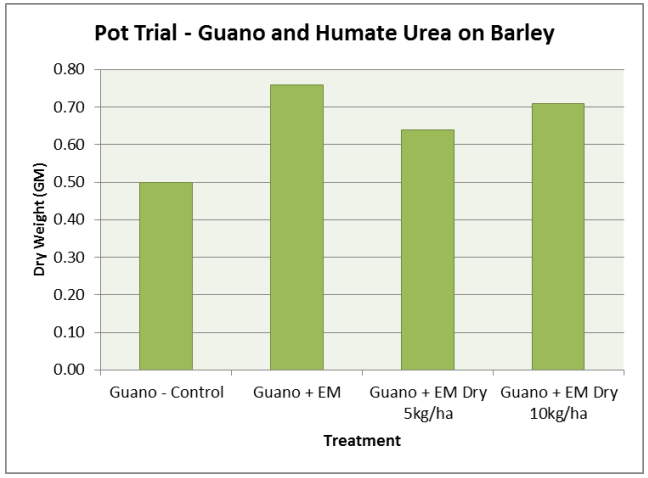
Enhancing Fertiliser Inputs

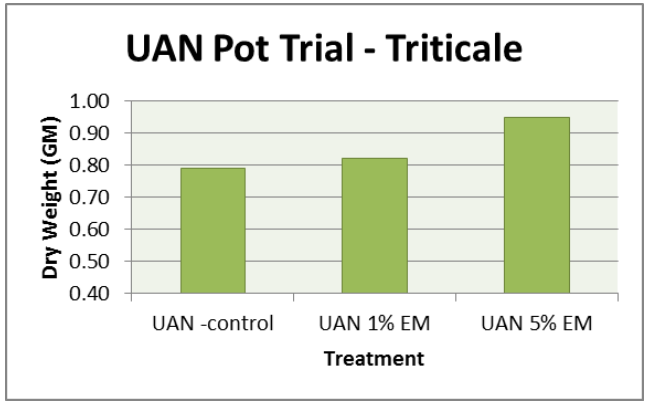
The microbes in EM will solubilise compounds both organic and inorganic that are largely unavailable to plants and make them available for uptake by the plants root system allowing the plant to put more energy into growth. In performing this important function the Microbes create a more efficient use of added nutrients, generating a better growth response from fertiliser inputs.

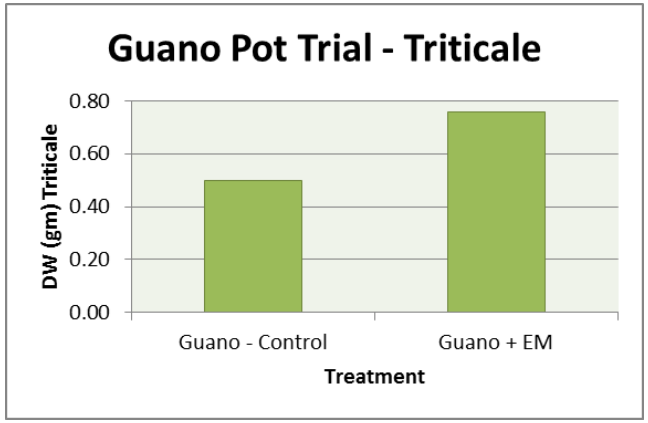
Research has shown EM stimulates *Mycorrhizae* and *Trichoderma* further enhancing nutrient uptake and the plants root system. EM works effectively with most fertiliser types.

Supporting Information

- EMNZ Fertiliser Trials
- Enhancing Fertiliser Inputs in Maize

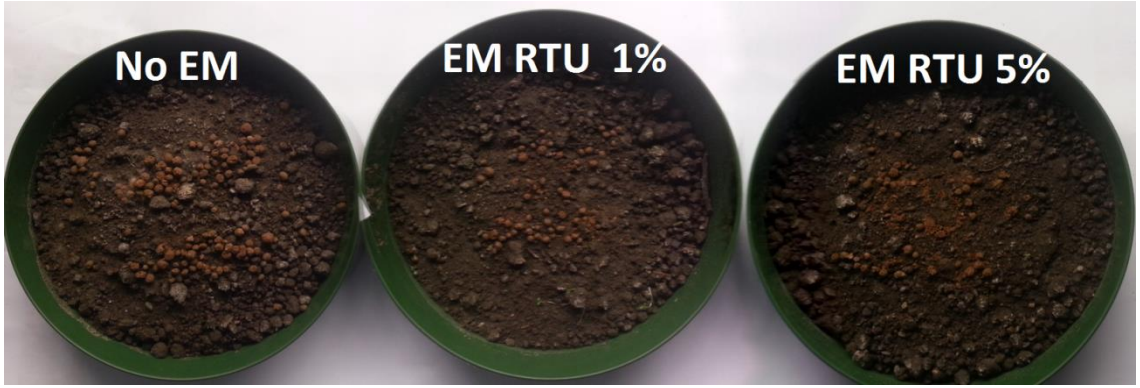


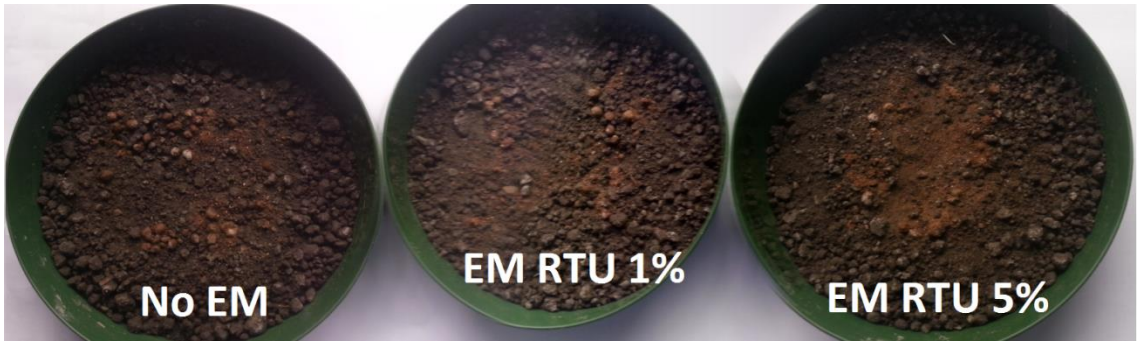




Fertiliser Breakdown

The below pictures show the impact of an application of EM on Guano. This trial was set up to show how the microbes in EM breakdown fertiliser compounds faster than a control. This was run over 2 weeks and as you can see the guano pots with EM application broke down much faster than the control.





Improved Root Structure

EM 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. The microbes in EM also have a symbiotic or mutually beneficial relationship with the roots of plants. So plants grow exceptionally well in soils dominated by these microorganisms with the promotion of root development.

Example

The below images shows the difference between crops treated with EM and without. The first image shows a huge number of extra roots on the treated paddock compared with the treated. The second was a paddock of clover treated with EM and one without. The main differences and the improved root structure and many nodules on the treated paddock. There was also a much better breakdown of organic matter in the soil.

Improved Germination

- EM makes germination more effective, thus significantly increasing the number of germinated seeds. It will influence root growth positively which has an important role in nutrient uptake.

- EM also has a positive effect on soil fertility creating an environment where a seed is more likely to germinate and thrive.

- EM can be applied directly when sowing to inoculate the soil immediately.

Supporting Information

- Effect of EM on Germination and Seedling Growth
- Influence of EM on Seed Germination and Plantlet Vigor of selected crops
- Effect of EM on Seeds

Reduction of Soil Compaction

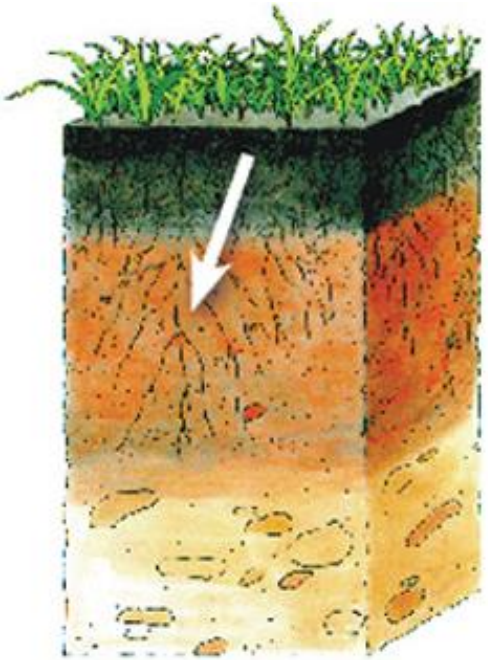
In order to reduce compaction EM will support the growth of other beneficial organisms like mychorrizae, worms, and insects already in your soil, bringing nature back into balance. It will also produce lots of polysaccharides - glues that hold the soil together and hold in moisture, improving drought resistance. A healthy soil and stimulated biological activity help build stable aggregate and soil structure. Increasing aggregate stability, prevents the pore spaces between the aggregates from collapsing during heavy saturating rains, and reduces compaction. Improved soil aggregate stability reduces soil erosion and run-off. Soils are better able to absorb and retain moisture as well as drain moisture when needed.

Example

The image illustrates a paddock trial on the west coast which showed EMs ability to reduce soil compaction. The untreated block was fertilised as per normal where as the treated block had 10L of EM and 10L of molasses per ha.

Improved Organic Matter Breakdown

- 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.



Supporting Information

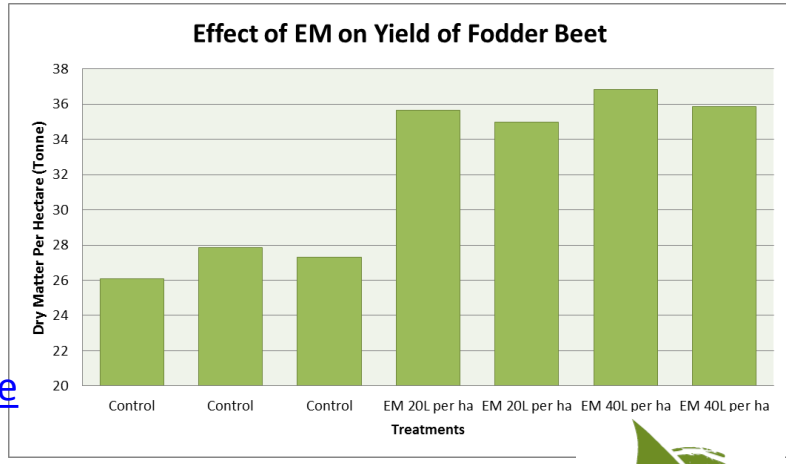
- Long-term effective microorganisms use promotes growth and increases yields and nutrition of wheat in China

Improved Yield

EM improves yield firstly through effective organic matter recycling which builds humus, the food for your soil and plants. It will also enhance fertiliser and nutrient breakdown in the soil and uptake by plants, will give improvements in nitrogen fixation and stimulate micorrhyzal activity.

This creates better growing conditions and this leads to a stronger healthier plant. Secondly EM provides competitive exclusion, which means that it out-competes pathogens for space, by inoculating the leaf surfaces with beneficial microbes allowing crops to thrive and reach their growing potential.

Using EM improves soil health by stimulating and feeding native microbial life in the soil which creates a higher yielding crop.

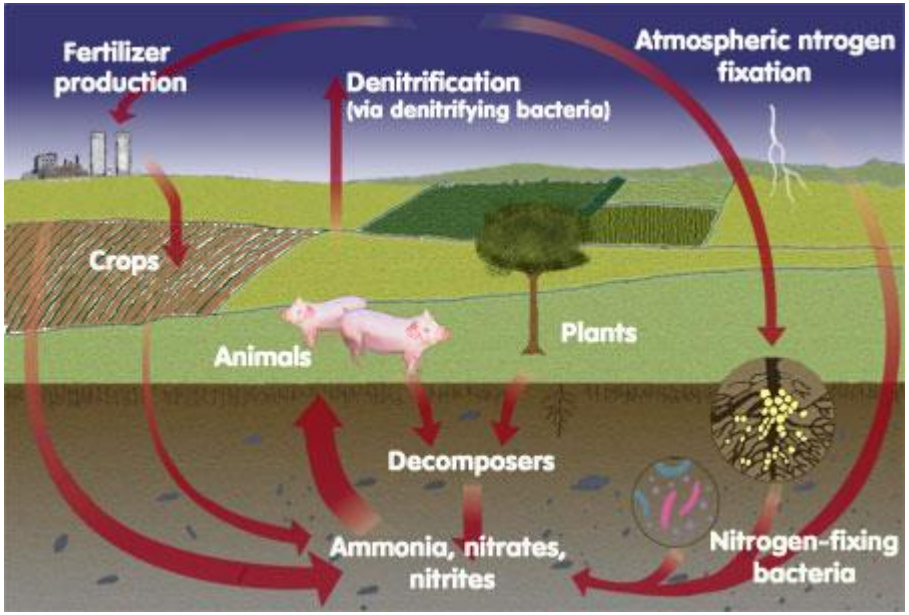


Supporting Information

- Improved yields in Maize Crops
- Innovative use of a microbial technology (EM) for large scale vegetable, arable and stock production in NZ
- Influence of effective microorganisms (EM) on vegetable production

Enhanced Nitrogen Fixation

When EM is applied to soil or plant leaf surfaces, the populations of photosynthetic bacteria and nitrogen fixing bacteria increase dramatically. The phenomenon is associated with the growth of more vigorous plants, higher plant yields and improved crop quality compared with no EM treatment. It was thought that the high number of photosynthetic bacteria and nitrogen fixing bacteria in soil and at leaf surfaces might enhance the plants photosynthetic rate and efficiency, and its nitrogen fixing capacity.



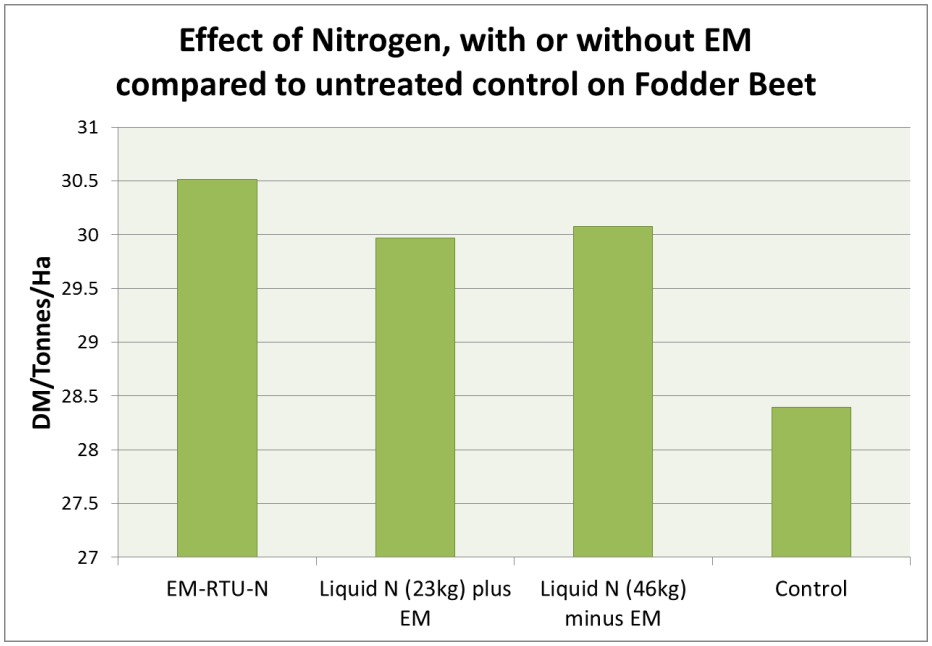
Supporting Information

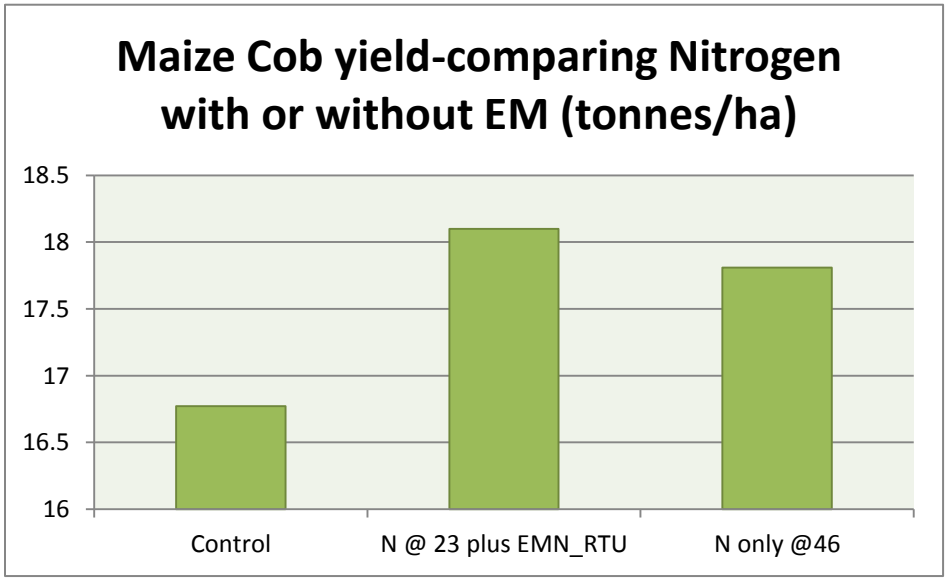
[Improved yields in Maize Crops]

[The concepts and Theories of Effective Microorganisms]

Improved Nitrogen Utilisation

- EM promotes nitrogen fixation to stimulate pasture (and clover) growth and drive more effective use of traditional nitrogen based fertilisers such as urea.
- EM is a soil decomposer which will release available N through organic matter recycling
- EM will also convert N compounds in the soil making them plant available and also decreasing the likiehood of leaching
- In the end EM will deliver more from your N inputs, fix more atmospheric N and reduce Leaching giving you a better overall N response.





Producing Plant Growth Regulators

- One of the many activities that EM does in the soil and plant is the production of what are called, plant growth regulators- PGRs. One of the commonly known PGRs are Gibberellins (ProGibb).
- PGR compounds are hormones, and have an important role in plant growth, often called phytohormones, they regulate growth, development, and the plants responses to stimuli.
- The microbial species listed in this table, are all present in EM, and have all been shown to produce various PGR's as published

TABLE 4. Plant growth regulator (PGR) producing microorganisms contained in the microbial inoculant used in the present study.

Microbe	PGR produced	Researcher	Document
Actinomycetes spp.	IAA, ICA	Larsen et al. 1962	Phyiol Plant 15: 552-566.
	IAA, ICA	Kaunat 1969	Zentrbl Bakteriol Abt II 123: 501-515.
	IAA	Purushothaman et al. 1974	Curr Sci 43: 413-414.
	IAA	Clark 1974	Microbios 11A:29-35.
	IAA	Barea et al. 1976	J Appl Bacteriol 40: 129-134.
	GLS	Panosyan et al. 1963	*Proc Symp Rel Soil Micro Plant Root*, Prague, p. 241-244.
	GLS	Kampert et al. 1975	Acta Microbiol Pol 7: 157-166.
	Cytokinins	Bermudez de Castro et al. 1977	*Recent Developments in Nitrogen Fixation*, Academic, London, p. 539-550.
	Cytokinins	Henson & Wheeler 1977	Z Pflanzenphysiol 84: 179-182.
Streptomyces spp.	IAA, IPyA	Mahmoud et al. 1984	Zentrbl Mikrobiol 139: 227-232
Aspergillus spp.	IAA, GLS, GA	El-bahrawy 1983	New Phytol 94: 401-407.
	IAA, GLS, GA	Dvornikova et al. 1968	Microbiol 37: 190-193.
Mucor hiemalis	Ethylene	Lynch 1974	J Gen Microbiol 83: 407-411.
S. cerevisiae	Ethylene	Thomas and Spencer, 1977	Can J Microbiol 23: 1669-1974.

Clover

- Clovers in pastures growing under near ideal conditions can fix in excess of 240 kg of nitrogen per ha per year.

- The use of EM stimulates clover growth and production. By stimulating the microbial activity in the soil the microbes help to provide the extra plant available nutrients required for clover while providing the environment for increased numbers of beneficial earthworms.