



EM USERS MANUAL



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NOTE TO THE PICTURES:

All figures are deliberately as outline only, so that you or your children can colour them in as to your preference!

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EFFECTIVE MICROORGANISMS

Introduction

Microorganisms are in abundance everywhere and have a large influence on biological and chemical qualities such as the extent of putrefaction, fermentation, disease, and oxidation of any system. Human dependence on this microbial world is described in detail in the book Microcosmos, Four Billion Years of Microbial Evolution, by microbiologists Lynn Margulis and Dorion Sagan, "microorganisms are not only the building blocks of life, but occupy and are indispensable to every known living structure on Earth today. We are both surrounded by them and composed of them. From the paramecium to the human race, all life forms are meticulously organised, sophisticated aggregates of evolving microbial life" (1986). Prior to the development of EM, the ability to manage these microbial populations on a large scale in an economically viable way did not exist. EM has therefore become a revolutionary tool for managing the dominant microbial populations and increasing the efficiency of many biologically-dependent systems.

Historical

EM owes its discovery to the work of Dr. Teruo Higa, professor, horticultural microbiologist, and organic farming researcher from the University of the Ryukyus in Okinawa, Japan. Coined by Dr. Higa, EM is an acronym for "effective microorganisms". Dr. Higa began to develop EM in the 1970's while looking for an alternative way to produce high quality agricultural products without using agricultural chemicals such as chemical fertilisers, artificial hormones, chemical pesticides and etc. Dr. Higa made an accidental discovery while researching the various beneficial aspects of isolated strains of microorganisms on soil composition and plant growth. In 1982, Dr. Higa learned that when blended in a state of balance, certain mixtures of beneficial microorganisms promoted "healthy plant growth, resulting in more abundant harvests of better tasting crops" (Higa, 1993). After months of testing these mixtures on seasonal crops of mandarin oranges with entirely positive results, Dr. Higa was sure that he had made an astonishing discovery.

According to the EM Research Organisation, "EM consists of a wide variety of effective, beneficial and non-pathogenic microorganisms produced through a natural process and not chemically synthesised or genetically engineered" (1995). Because EM is produced using a natural process, the specific species and their population densities that exist in EM can be different, based on differences in starter culture, culture media, growth environment, growth methods, and incubation times. EM is often referred to as the "naturally occurring, beneficial microorganisms of our world".

EM has developed over the past twenty years and is now used commercially in various fields worldwide including agriculture, livestock, waste treatment, bioremediation, human health, recycling, and more. Because of its effectiveness and economic viability, EM technology has spread worldwide. EM was initially developed and effectively used as inoculate for soil conditioning in grain, vegetable and fruit production with very beneficial results. As the research and applications of EM developed throughout the 1980's and 1990's EM was found to be an effective tool for manipulating and managing the overall microbial ecology of complex and diverse systems. During the mid-1980's, livestock researchers and producers in Japan began to test EM for odour control and

waste management. EM began to be used in treating sewage water at the end of the 1980's (EM Research Organisation, 1995). This research continues to the present and has verified EM to be effective as a pro-biotic, waste treatment and biological control agent (Kitazato Environmental Center, 1994). One of the most valuable contributions of EM to the livestock industry is its deodorising effect within confined facilities for poultry operations. EM eliminates odours by dominating the microbial ecology with organisms that exploit a fermentative pathway and therefore do not produce odorous gases (Yongzhen and Weijiong, 1994).

During the early 1990's, the EM Research Organisation was established in Okinawa, Japan to further research, develop and implement EM technology. EM technology is now available in many forms and products in over 100 countries. Each product, as endorsed by Dr. Higa, contains the basic mixed culture of phototrophic bacteria, lactic acid bacteria and yeast. Because of the hundreds of thousands of users from all walks of life, the technology is constantly evolving and spreading into new fields. This is made possible because Dr. Higa's discovery of the basic working principles of EM technology seem to be fundamental principles of life and microbial ecology, that are applicable throughout many aspects of human life, agriculture and industry.

EM has been thoroughly tested and proven safe for human and other animals. The United States Department of Agriculture categorises most of the microorganisms in EM as G.R.A.S. (generally recognised as safe) (EM Technologies, 1997).

Microorganisms and soil ecology

Nobody would deny that the soils play an integral role in the production of healthy crops. Yet there are very few people who are aware of the fact that the soil itself exists under a complex balance of a vast number of different microorganisms. Soil diseases are considered to be the most damaging to crops among crop diseases. Soil diseases occur when the balance among microorganisms in the soil is disrupted. Anyone would then be led to wonder if it is not possible to restore this balance by artificially injecting these microorganisms into the soil. In fact many researchers have made such attempts but most of them failed. According to conventional theories it is generally accepted that it is no use putting artificially cultivated microorganisms into the soil. This theory has a fault in that farmers used single types of microorganisms or sprayed specific microorganisms to suppress disease in a sympathetic treatment to suppress diseases. This was done without properly understanding the meaning of disease and insect infestation in nature.

And so bearing this fully in mind, studies were conducted over a long period of time to find out the best combinations of microorganisms in the soil that would enable plants to grow healthily. As a result it was found that if there are many disease causing and putrescent microorganisms in the soil, that is, if the soil becomes a disease inducing soil, the infestation of disease and insects often occurs. These conditions are encouraged through the application of raw organic materials. On the other hand if predominantly beneficial microorganisms in the soil are groups that suppress disease such as ray fungi, Penicillium or Trichoderma and Streptomyces then the soil changes into disease suppressive soil.

It has also been found that if organic matter in soils is allowed to ferment through decomposing then the soils ability to suppress disease increases and the utilisation rate of the organic matter also increases. These soils are classified as Zymogenic soils.

Zymogenic (nutrient sharing microorganisms) soils are soils that contain microorganisms such as lactic acid bacteria and yeasts. The population of fermentable fungi such as *Aspergillus* and *Rhizopus* are also increased. In soils there are also groups of microorganisms that produce saccharides and amino acids that fix vitamins and nitrogen. When these groups become dominant the soil can make itself fertile. These soils are classified as Synthetic soils and contain nutrient synthesising microorganisms such as photosynthetic and nitrogen fixing bacteria. When we can create conditions for Zymogenic-Synthetic soils these conditions are ideal for organic crop production. In this way soils can be classified according to their micro flora.

These various microorganisms are cultured and are known as EM or Effective Microorganisms.

EM is now used for various practical applications. There are more than 80 different microorganisms including Actinomycetes, Photosynthetic bacteria, Fermenting fungi, Yeasts, and Lactic acid bacteria found in EM.

Types of microorganisms found in the Effective Microorganisms

Photosynthetic Bacteria:

The Photosynthetic Bacteria group are the leaders in EM. They break down harmful substances and produce antioxidants. As independent, self-supporting microorganisms Photosynthetic (phototrophic) Bacteria synthesize useful substances from root secretions, organic matter and /or harmful gases. The useful substances secreted include amino acids, nucleic acids, bioactive substances, antioxidants and sugars. They all promote plant growth and development naturally and are directly absorbed by the plants. They also act as substrate for other microorganisms e.g. Photosynthetic Bacteria secrete nitrogenous compounds (amino acids), which are used by VA (vesicular arbuscular) mycorrhiza. Mycorrhiza increases solubility of Phosphate in soils. VA also coexists with Azotobacter (free living nitrogen fixing bacteria) and enhances nitrogen fixing ability of *Rhizobium* sp. in legumes.

Lactic Acid Bacteria:

Lactic Acid Bacteria promote fermentation and produce organic acids that suppress pathogens. They form lactic acid from sugars and other carbohydrates produced by Photosynthetic bacteria and yeasts. They have been used in making food - pickles, yoghurts etc. for a long time. They are strong natural sterilisers that help to eliminate harmful microorganisms. They enhance the natural breakdown of hard to decompose matter e.g. lignin and cellulose and they eliminate *Fusarium* sp. and as a consequence harmful nematodes.

Yeasts:

Yeasts promote fermentation and produce useful substances for plant growth from amino acids and sugars found in soil organic matter and from the secretion of the Photosynthetic bacteria. They produce bio-active substances such as hormones and enzymes promoting active cell and root division in plants. Their secretions are substrate for other effective microorganisms such as Lactic acid bacteria and Actinomycetes.

EM can improve the chemical, physical, biological and microbial aspects of the soil. It is readily available, cost effective, easy to use and is environmentally safe.

EM USE IN HORTICULTURE

The use of EM in horticulture is divided into two areas:

- The use of EM in improving soil conditions and soil fertility indirectly influences plant growth and health.
- The spraying of Activated EM and EM derivatives protects the plants from pests and diseases as well as improves plant growth and yield

Vegetables and Flowers

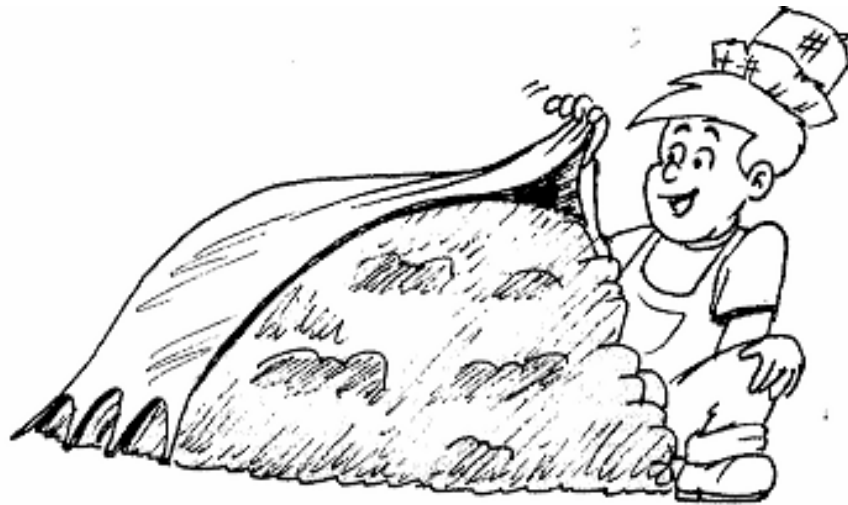
Production of good potting soil for seedling production:

Materials:

- 95% potting soil
- 5% Manure Bokashi
- 1:100 Activated EM/water mix
- Crop guard fleece or Jute (Hessian) bags

Preparation:

1. Mix the potting soil with the manure bokashi
2. Add the Activated EM/ water mix so that the soil is moist, but not soaking wet.
3. Gather the soil into a heap and cover with the fleece or hessian bags, so that the soil can still breathe.
Cover the soil that it can breathe and ripen for two to three weeks



4. Let the soil ripen for two to three weeks. After this time it can be used in your seedling trays or planting pots. You will possibly see the soil full of white filamentous fungi, which is beneficial and desirable.

Test the soil so that it is not too wet or too dry. Press a portion in a hand into a dumpling. When you open your hand and touch that dumpling it should fall apart easily.



Sowing and planting

Prepare the soil can be well prepared with Bokashi, see description below. Seeds can be prepared in soaking in a diluted Activated EM solution (1:500). This coats and inoculates the seed with EM to protect against soil-borne pathogens as well as giving the seedlings a good start. Non-organic seed is often coated with a chemical, this should be washed off before soaking in EM!



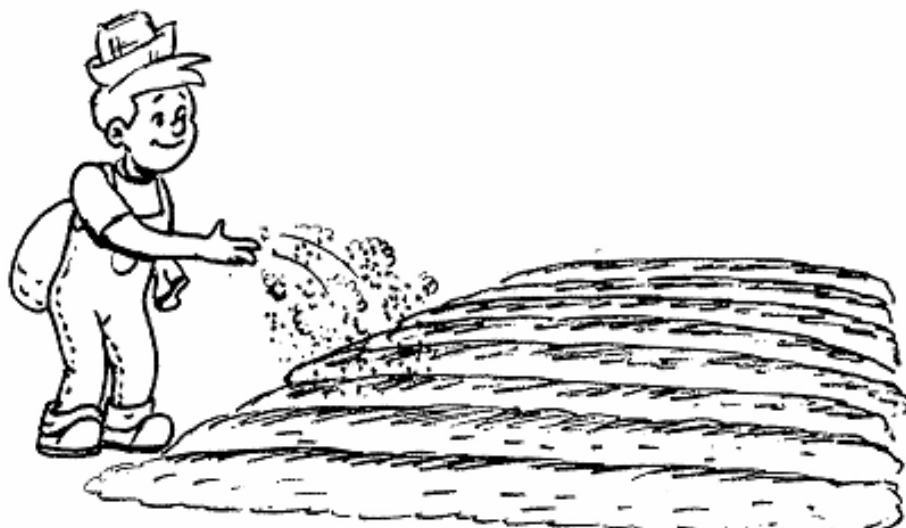
Coating seeds with EM:

After soaking the seed need to be allowed to dry in the shade. When it is possible to make a light indentation with the fingernail in the see, it has the right moisture content.

Seeds	Soaking time	Multi EM : Water mix
Small seeds	30 minutes	1:500
Medium seeds, e.g. Maize	4 – 6 hours	1:500
Large seeds, e.g. Beans	24 – 48 hours	1:500

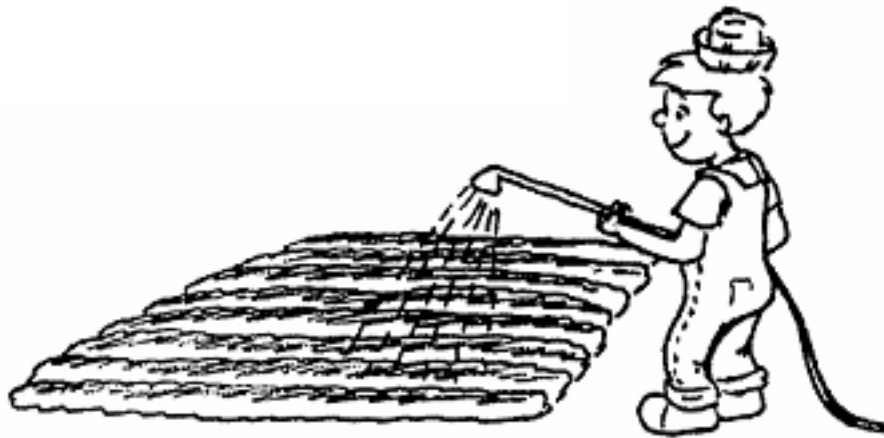
Preparation of the ground:

1. When the soil has warmed sufficiently after the winter time (if applicable), above 8° C, work 200 grams to 1 kilogram Manure Bokashi lightly into your soil.



Incorporating manure Bokashi into your topsoil at 200 grams to 1 kg per m²

2. After working in of the Manure Bokashi the soil has to be irrigated with a Activated EM : Water solution of 1:100. Microorganisms like it warm and moist.



Irrigate your soil with 1:100 Activated EM : Water solution. Please beware!

3. When everything has been moistened it is important to cover the area with mulch to prevent the drying out of the soil. This can be done with organic matter like hay, straw etc. or with agricultural fleece.
4. Now we have to give the soil organisms time to prepare the soil for our seedlings/seeds and that the relatively low pH of the Bokashi can adjust itself to the pH of the soil. Very important metabolic processes happen in this time in the soil. Are seedlings/seeds planted too early, the young plantlets can suffer from the low pH.

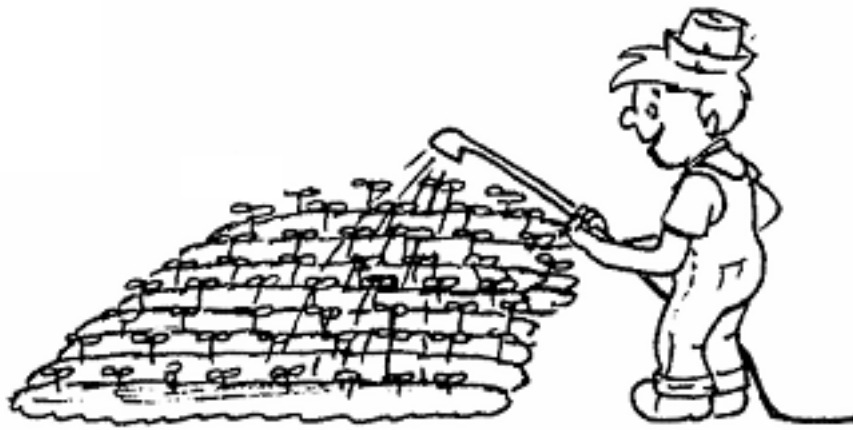
Mulching

It is recommended to keep the soil covered with a mulch at all times. Mulch can be any organic matter that you can lay your hands on. Mulching is an important method for:

- Retention of soil moisture
- Equalising soil temperatures
- Maintaining a suitable environment for microorganisms and also EM
- Suppressing weeds
- Erosion control
- Improving physical soil quality
- Increasing organic matter as food for soil organisms

Before and after planting respectively sowing

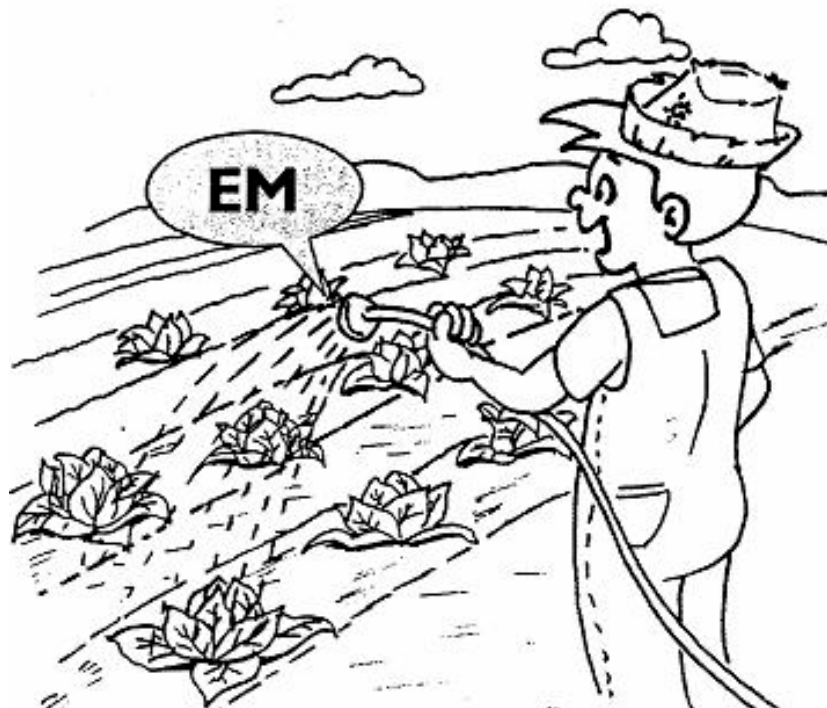
1. After planting or sowing, water the soil and/or the plantlets thoroughly with a Activated EM : Water mix of 1:1000 until the soil is thoroughly moistened. The quantity of the mix does not matter, irrigate until the soil is completely saturated.



After sowing or planting water well with Activated EM : Water mix at 1:1000

During the active growing phase

1. Depending on plant type, water for a month every week once with Activated EM : Water solution 1: 1000. More frequent applications do no harm. Shorten the application intervals and as good growth is observed increase intervals.



During growth irrigate regularly with Activated EM : Water solution at 1:1000

2. Manure - Bokashi can be moderately added as a fertiliser. Do not add too much Manure - Bokashi at once and not too close to the plants, at a distance of 10 – 15 cm from the plants is suggested.



Regular feeding with Manure – Bokashi is beneficial to the plants growth

3. Never apply Activated EM in a stronger solution than 1:100. Due to the low pH value stronger concentrations of Activated EM can cause physiological harm in the plants or yellow spots on leaves, especially during dry periods.
4. A combination with agrochemicals is not advised
 - Do not use EM in higher concentrations than 1:100!
 - Do not mix EM with chemicals



Plant protection

There are a couple of possibilities to protect our plants of Pests and disease with the help of EM. For this purpose various products can be produced with EM and other natural ingredient, which are sprayed onto the plants:

- Fermented Plant Extract (FPE)
- EM 5
- EM 3 – in – 1

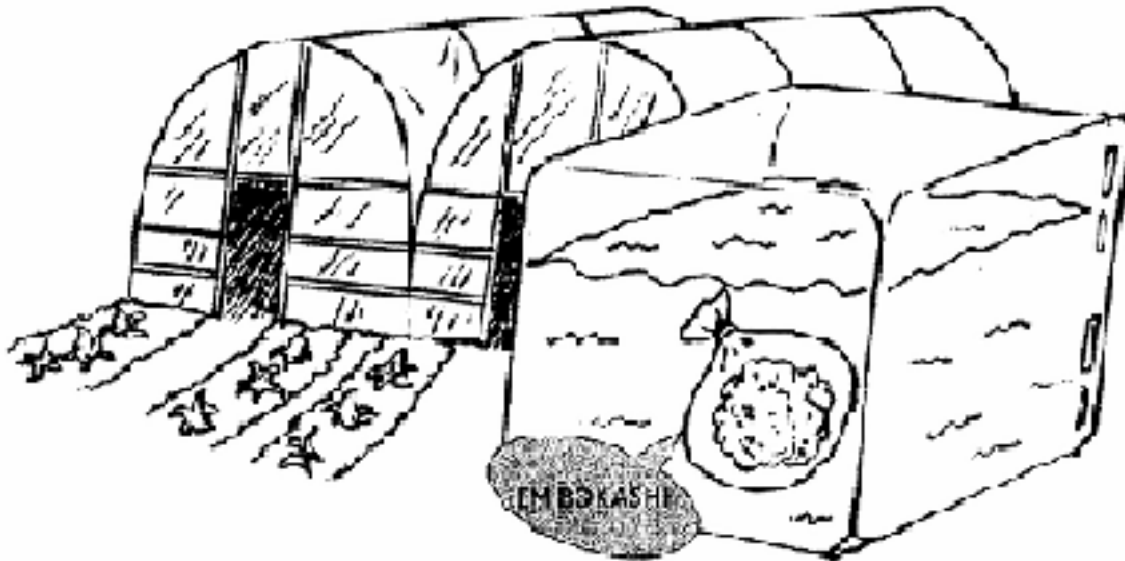
The recipes to those are listed below.

Bokashi - soup

The so-called Bokashi soup is used as a foliar feed and to deter insect pests.

Example

1. Add 5 kg of Bokashi into a hessian bag, or any other water-permeable bag.
2. Place this bag into 50 litres of water for 8 to 12 hours, so that all the nutrients and Microorganisms are dissolved out of the Bokashi.
3. Remove the Bag and add 450 litres of fresh water to the brew.
4. Add to this 500 litre Bokashi – soup 1 litre EM 5 and stir well.
5. Spray this mixture within 24 hours on your crop. It is ideal for greenhouse growing. Bokashi – soup does not keep for long and needs to be utilised quickly.



Bokashi-soup with EM 5 as foliar feed and insect repellent (1:500)
Instead of soaking Bokashi in a bag, 1 litre of fresh Bokashi – juice
(see recipe below) can be mixed into the water (1:500)

Fermented Plant Extract (FPE)

By fermenting various plants their active ingredients are bound within the Activated EM. This can be applied in a diluted form on plant and soil.

To make FPE any plants can be used that are full of life and growth forces, especially so called weeds, medicinal herbs and plants with aetheric oils. Poisonous plants however should not be used!

Regular spraying of FPE together with EM 5 every 7 to 10 days, in a 1:500 dilution encourages healthy and strong plants and protects them against pests and diseases. Adding 0.1 % of Molasses as a sticker increases the effect.

Example: 1 litre FPE + 1 litre EM 5 + 0.5 litre Molasses + 500 litre water.



Regular spraying of plants with FPE & EM5 at intervals of 7 - 10 days at a 1:500 dilution from the beginning of active growth, supports the plants to ward off illnesses and pests. This is ideally done into the morning dew, after a rain or after sunset.

Plant protection against insect attacks with EM 3-in-1 (EM insecticide)

In case of massive harmful insect attack, we can utilise the strong contact poison properties of various hot spices through fermenting with EM. We call this potion EM 3-in-1 (recipe below).

We only recommend using EM 3-in-1 when there is a real problem with insects, since it can also harm beneficial ones. EM 3-in-1 is sprayed at a dilution of 1:500 to 1:1000 in regular intervals until the problem has disappeared. We have very good preventative results, when it is mixed with EM5 and FPE and sprayed at weekly intervals in a 1:500 dilution.

Foliar feeding

There are times, when our plants look stressed and malnourished, for whatever reason. It is then that we can utilise foliar feeds to give the plants a boost. They are:

- Fermented chicken manure (FCM)
- Fermented Fish (FF)
- Bokashi soup

Recipes for those are listed below.



Harvest

After harvesting it is of benefit to the development of the soil to leave all plant residues also diseased ones and work it lightly into the soil. One also calls this sheet composting. This is done with incorporating small amounts of Bokashi and/or Multiplied EM at 1:100. Ideally the whole area is then mulched with straw, leaves, veldt grasses etc.



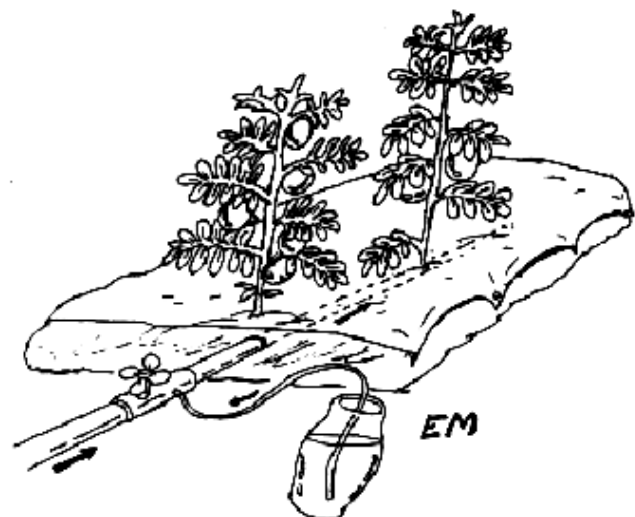
It is very important to supply lots of organic matter to the soil. Leave plant residues on the field and lightly incorporate into the soil together with Bokashi. Then cover with a mulch and water Activated EM at 1:100 liberally onto it all.

The use of EM in automatic irrigation systems:

EM products can also be supplied through automatic irrigation systems. In this case one just has to bear in mind that certain microorganisms encase themselves in a slime for their protection, should there be any residues in the water. This can lead to blockages in the pipes. To avoid this it is recommended to inject EM in intervals, so that in the times in between the pipes are flushed adequately.

!!! Attention !!!

To avoid blocked pipes through slimy microorganisms, do not have a continuous EM supply. Inject EM in intervals and let the pipe system flush in the process of the alternate irrigation cycles.



EM application for field crops (Sugar Cane, grains, vegetables etc.)

Note: This is just a recommended application of EM and should not be considered the only way to apply EM. Most of these applications are for EM inoculation, which is the most basic EM application.

After harvest of crop:

- Incorporate crop residues if possible
- Apply 500 kg - 3 tons of EM compost/ha (The amount of EM compost used will depend on the fertilisation program followed).
- Spray 50 litres of Activated EM/ha at a 1:200 dilution.

Before planting/during ploughing/cultivating:

- Apply 500 kg – 3 tons of EM compost/ha
- Spray 50 litres of Activated EM at a 1:200 dilution

During planting:

- Apply 50 l Activated EM together with the fertiliser. Humic acid or Molasses can also be added to provide nutrients to plants and EM's, especially if the soil is lacking organic matter.

During Growth:

- Add 50 litres/ha to the irrigation water during every irrigation cycle

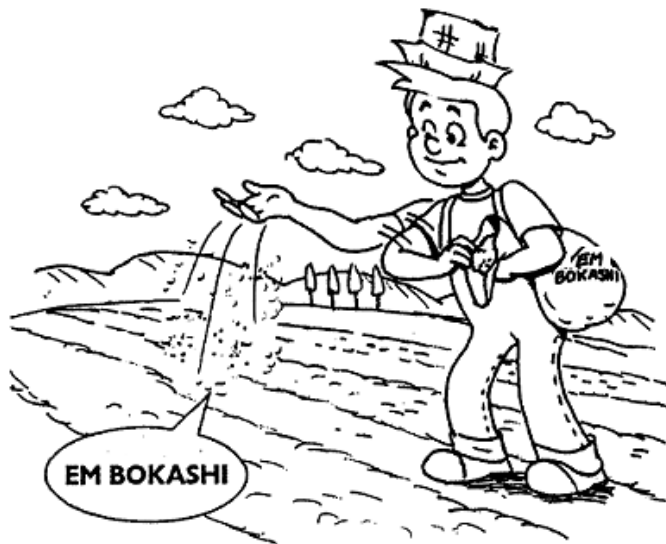
EM for Orchards

It is important to choose the right varieties of fruit trees and the appropriate management in the orchard according to the specific locality. It is also important to take care in choosing stock of high quality and health – it is expensive to replace fruit.

Soil preparation

- Broadcast 300 – 1000 kg Bokashi over the soil at the beginning of rainy season
- Water liberally with Activated EM at 1:100 dilution
- Cover with a thick mulch

It is important in establishing an orchard to prepare the soil very carefully because the plantings usually stay in the same place for longer periods. Through Green manuring and liberal application we can bring enough organic matter into the soil.

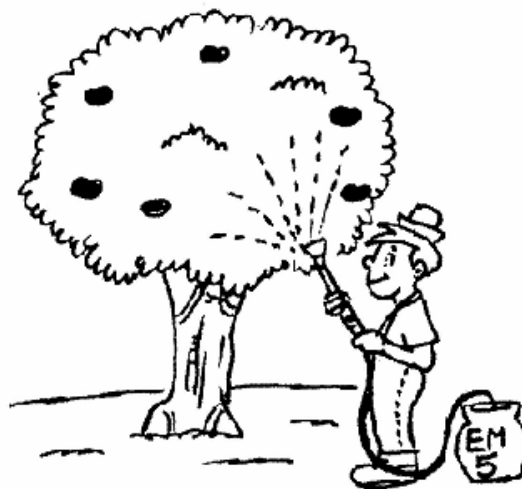


Before and after planting:

- Add 1 shovel full of Bokashi to the plant hole and mix thoroughly with the soil.
- After planting the tree, mulch the soil thickly, taking care to leave a gap around the stem.
- Water everything liberally with Activated EM at a 1:500 dilution.

Growth phase (frost free time):

- Water regularly with 1:1000 Activated EM dilution
- Fertilise once a month with some Bokashi (100 gram per tree)
- Spray the trees regularly at intervals of 7 – 10 days with an EM5/ FPE mixture at 1:100 – 3:100 to prevent insect and disease attack
- In the event of persistent pests spray EM 3-in-1 at 1:500 on the plants



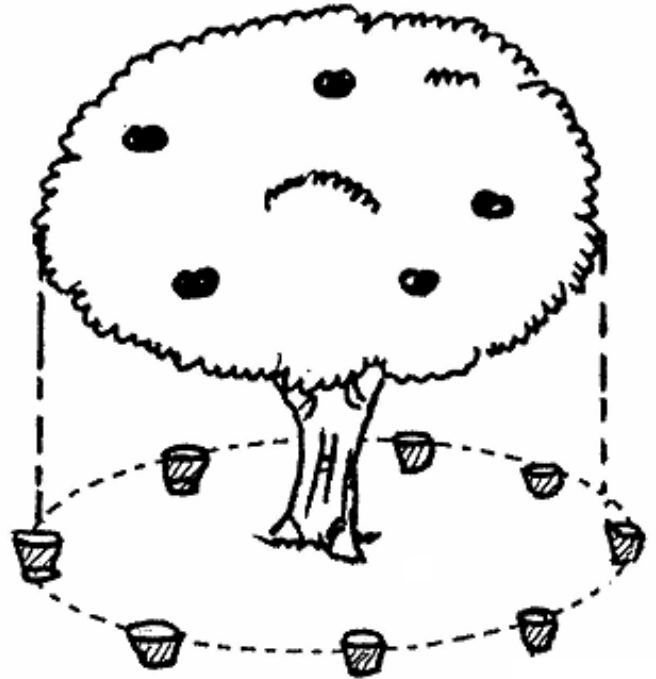
During the active growth period spray the plants regularly with EM5/FPE to keep illnesses and pests at bay. Always spray in the evening or very early in the morning.

Bokashi fertilisation on larger trees

In an organic orchard it is especially important to bring organic matter and nutrients into the root zone. We do this in creating depots.

Example 1:

Bokashi is supplied in 15 – 20 cm deep holes as store. All around the drip line of the tree 2 – 3 nutrient stores per m² are created



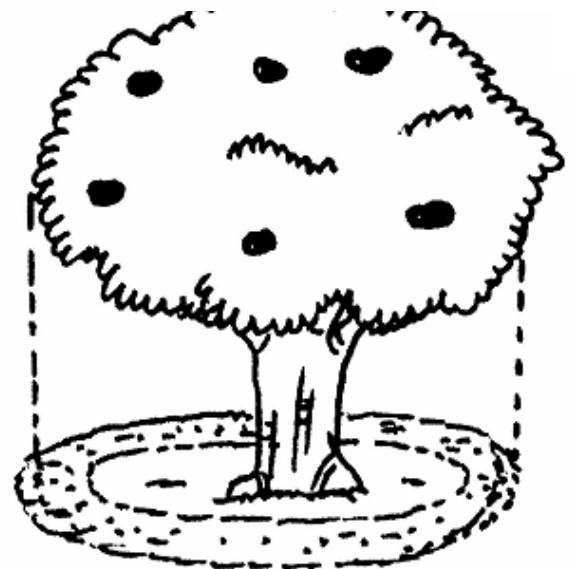
EM-BOKASHI

Example 2:

The nutrient depot is supplied in the form of a ditch around the drip line of the tree.

After harvesting:

After harvesting it is important to make sure that the tree disk is covered with mulch, to prepare the plants for winter. Remember to keep a non-mulched space around the stem. Spray the material liberally with Activated EM at a 1:500 dilution.



EM-BOKASHI

Other Applications of Effective Microorganisms and brewing guidelines

The Effective Microorganisms are used in practical applications by several means. As discussed in some detail above they can be applied to plants, soils, compost, livestock and general environments as well. The EM1 is multiplied or activated using molasses and water. From this multiplied or activated EM several derivatives are made for specific needs or purposes. These will all be addresses in the following pages.

EM INSTRUCTIONS FOR ECONOMICAL USE

EM1

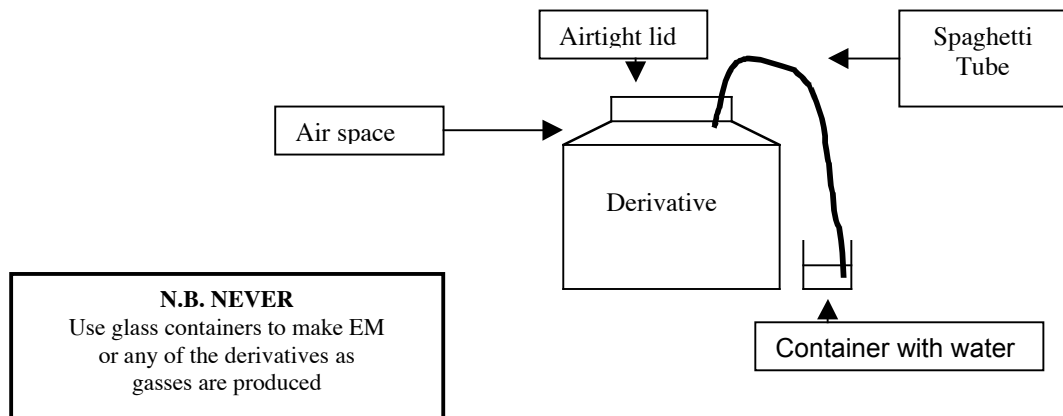
1. EM1 has a sweet-sour taste and smell (pH below 3.7).
2. It needs to be stored in an airtight plastic container. Gas needs to be released occasionally.
3. The best temperature for storage is between 15 and 20 degrees Celsius with little fluctuation (less than 10 degrees Celsius in 24 hours).
4. It needs to be stored away from direct sunlight, preferably in a storeroom.
5. Ideally blankets or bubble sheets should be used as insulator at the top and the sides of the containers. The container should be placed directly onto the ground in summer for coolness and in winter the insulation should be placed under the base of the container as well.
6. The beige/white fungi appearing on the surface are beneficial in EM.
7. The shelf life for EM1 is 9-12 months.

How to make Activated EM

PLEASE NOTE: ONLY ACTIVATE/MULTIPLY EM ONCE!!!

Multiplications of Activated EM will be inferior (basically a lactic acid soup), due to uneven ratio of multiplication of the various Microorganisms and will not give you good results!

- o Materials
 - . 5 % good quality EM1
 - . 5 % pure liquid cane molasses
 - . 0.1% pure sea salt, or sea water or ideally 0.05% of our specially formulated mineral mix.
 - . 90 % clean water
 - . Borehole drinking water
 - . City water: containers with city water need to be left open in the sun for up to a day to get rid of the chlorine before being used.
 - . Temperature 35-42 degrees Celsius is best (a range from 15 – 49 degrees Celsius is allowed)



- o Preparation
 - o Mix the molasses in warm water to dissolve it completely.
 - o Mix EM1 into the molasses water.
 - o Mix in the salt/mineral mix
 - o Fill the container with good (ideally warm) water. Leave a gap at the top with some air.
 - o Mix well.
 - o Seal the container airtight and release the gas often. With larger quantities use a breather pipe to release the gas, without needing daily control. For this, drill a hole in the lid of the container, seal a spaghetti tube into the lid and place the other end into a bottle filled with water. Now the gas can escape, but no oxygen goes back into the container (see diagram).

- o Good Activated EM
 - o When the Multiplied EM is ready it smells and tastes like the EM1.
 - o It is ready in 3 to 14 days, depending on the temperature.
 - o Favourable pH is below 3.7.
 - o Multiplied EM can be safely stored for 1 month but often extends to 3 months if conditions are favourable.

- o Use of Activated EM
 - o For Plants generally (detailed instructions in the preceding pages):
1:500 to 1:1 000 dilution Activated EM
If used, chlorinated water must be left in open air for half day before being used
 - o Seeds: Soak seeds in 0.1% EM, small seeds for 30 minutes, large seeds for up to 8 hours. Dry under shade to avoid sticking together. This process promotes faster and even germination as well as healthy growth of plants. This is not advocated for plants of the legume family.
 - o Potatoes/grain etc. 100 litre/ha in 400 litre water and 3 times per season. Best is before or after rain.
 - o Hops. 300 litre/ha Activated EM in 1000 litre water. 3 times per season.
 - o Flowers. Liquid fertiliser dosing system and mist spray in green house. All the tables are cleaned with EM
 - o Vegetables. 1:1000 spraying on gardens once per week, alternated with 1:1000 FPE.

- o Aquaculture: 1:1 500 (tilapia) – 1:5 000 (trout) dilution of Activated EM to begin with and can then be maintained at 1:10000. Spray 1% Activated EM directly onto feed and leave to dry under shade for 4 hours (or until dry). The feed can be used directly afterwards.
- o Soil:
1:100 to 1: 500 dilution of Activated EM
- o Compost/Manure:
1:100 dilution of Activated EM
100- 200 litre/m³ (depending on moisture in material)
- o Slurry – 2 litre/m³ (1% Activated EM). Let mature for 4 weeks. It then goes thinner and thinner and does not smell anymore. It is spread even on delicate leguminous plants with no problem at 10 m³/ha. Some farmers add still another dose of EM before spraying out.
- o Silage - 1 litre/m³ for grass and 2 litre/m³ for maize silage. Best is 35% moisture content. Fermentation is 6 weeks with grass. Leave raw material only for a short time in the open – every day you loose 1% sugar. Then compact quickly.
- o In the stable. Spray every 3 days with mist sprayer – 10 ml/m² depending on moisture in the stable. Overhead sprinklers. Add 1:1000 to drinking water.
- o Calf drink. 30 ml/animal – not leaving it in too long in the milk otherwise it begins to curdle.
- o Hoof bath. 1 – 2 % Activated EM in the walk-through bath, prevents rot and contributes to building healthy hoofs. Can be left in pan for up to a week.
- o Porkers. If the feed mix is self made, 10% Activated EM is added. Spray in stable as with cows. If liquid feed, such as whey, is used add 2 litre Activated EM to each cubic meter of (feed) liquid. One could also add 3% Bokashi into the grain ration. Alternatively mix 1:1000 into drinking water.
- o Chickens. From day 1 add 10% Activated EM into growers mix and 3% Bokashi into layers mash. Alternatively 1:1000 into drinking water through nipple drinkers. If they clog up, just flush through with clean water. Use EM5 against mites and be sure to spray into all the corners of the house! Before moving chicks into a new house, wash out house with 1:4% – 10% Activated EM with high-pressure hose. And then use EM chicken manure Bokashi into the shavings.
- o Washing machine. Apply 30 – 40 ml into the drum. Instead of softener put the Activated EM into the softener container. You will find that you will need only 1/3 of washing powder normally used
- o House cleaning. 30 ml in a 10-litre bucket for your entire domestic household cleaning.
- o Environmental Spray. In mist bottle at 1:500 to 1:1000 in the house on carpets, the air (air refresher) cupboards etc...
- o Sewage system. The daily inflow (number) in m³ is the weekly dose in litres of Activated EM (e.g. 20 m³ of sewage will need 20 litre Activated EM/week). It can reduce BOD by up to 90%.

EM Derivatives

1. EM-FPE (Fermented Plant Extract): Bioactive supplement of vitamins, hormones and enzymes. FPE prevents pests & disease of the plants and soil, too. The cost of making FPE can be very cheap if you use weeds, but using herbs will improve its quality and is then similar to EM Insecticide (Isseki-Sancho or 3-in-1).
2. EM 3-in-1 or EM Insecticide: This is a powerful contact poison and although organic and made from known spices, should ideally only be used when there is a problem. It will also harm beneficial insects. However it is often brewed together with the EM5 and sprayed preventatively.
3. EM-FF (Fermented Fish): This is a good foliar feed, acts as a tonic and provides Nitrogen to plants in slow release. The use on crops results in fruit sugar content rise and with constant application will help by supplementing photosynthetic bacteria and amino acids.
4. EM-FCM (Fermented Chicken Manure): this is a good foliar feed and will provide immediate N and P to the plant in times of shortages from the soil.
5. EM5: is an organic insect repellent and is non-toxic. EM5 is used to help prevent disease and pest problems in crop plants and is also effective for animals to prevent insects from attacking their skin. It is mainly used to repel insects by creating a distasteful barrier. EM5 also helps control diseases/pest attack by the mechanism of 'competitive exclusion', a form of natural biological control.
6. EM Bokashi: Bokashi is a Japanese word, which means 'fermented organic matter'. Make Bokashi by fermenting organic matter (e.g. bran, oilcake etc) with Activated EM in an airtight container. EM Bokashi is on one hand an important soil amendment used to promote the increase in plant nutrients and the abundance of beneficial microorganisms in the soil and on the other hand a valuable feed amendment and used for livestock. Use at a rate of between 1% and 3 % of their total diet.

How to make EM-FPE

- o Materials
 - o 3 % good quality Activated EM
 - o 3 % pure liquid cane molasses
 - o Clean water
 - ♣ Borehole drinking water
 - ♣ City water: containers with city water need to be left open in the sun for up to a day to get rid of the chlorine before being used.
 - o Temperature 20-25 degrees Celsius is best (a range from 15 – 37 degrees Celsius is acceptable)
 - o Container full of fresh weeds, herbs and other plant matter. When choosing appropriate plants the Japanese say use 'plants with lots of life'. This would mean that any plant, which shows by its' appearance a strong indication of its' health, can be used.
- o Preparation
 - o Put the weeds and plants (chopped 2- 5cm) into an airtight bucket or container. Lightly press down by hand and fill the bucket
 - o Mix the Activated EM and molasses into (warm) water and pour the solution into the container.

- o Close the container airtight, install breather pipe as with Activated EM if necessary (see diagram).
- o Store the container away from the sun in a warm place (20- 35°C)
- o Stir the weeds regularly to release the gas.

- o Good EM-FPE
 - o It is ready in 1 - 2 weeks.
 - o Favourable pH is less than 3.7
 - o Spray in a dilution of 1:1 000-1 500.
 - o EM FPE can be stored for 1 – 2 months.

- o Use of EM FPE
 - o Spray on plants at 1:500 to 1:1000
 - o Spray on soil (to suppress disease) at 1:100 to 1:500

How to make EM Insecticide or EM 3-in-1

- o Materials
 - o 3% good quality Activated EM
 - o 3% pure liquid cane molasses
 - o Clean water
 - ♣ Borehole drinking water
 - ♣ City water: containers with city water need to be left open in the sun for a day to get rid of the chlorine before being used.
 - o Temperature 20-25 degrees Celsius is best (a range from 15 – 37 degrees Celsius is acceptable)
 - o 2 % by weight Chilli
 - o 2 % by weight Garlic
 - o 2 % by weight Ginger
 - o 2 % by weight powdered Black Pepper (second grade)
 - o Should some ingredients be not available locally, they can be replaced with a herb/spice of similar action.

- o Preparation
 - o Put the spices (chopped or minced) into an airtight bucket or container.
 - o Mix the Activated EM and molasses into (warm) water and pour the solution into the container.
 - o Close the container airtight, install breather pipe as with Activated EM if necessary (see diagram).
 - o Store the container away from the sun in a warm place (20 - 35°C)
 - o Stir regularly to release the gas.

- o Good EM 3-in-1
 - o It is ready in 1 - 2 weeks.
 - o Favourable pH is less than 3.7
 - o Spray in a dilution of 1:1 000-1 500.
 - o EM 3-in-1 can be stored up to 6 months.

- o Use of EM 3-in-1

- o Spray on plants at 1:500 to 1:1000
- o Mix with EM5 at a rate of 50/50 and use as a preventative spray

How to make EM-FF

- o Materials
 - o 3 % good quality Activated EM
 - o 3 % pure liquid cane molasses
 - o Clean water
 - ♣ Borehole drinking water
 - ♣ City water: containers with city water need to be left open in the sun for a day to get rid of the chlorine before being used.
 - o Temperature 20-25 degrees Celsius is best (a range from 15 – 37 degrees Celsius is acceptable)
 - o 10 % by volume crushed fish or fishmeal, preferably of blue skinned fish, e.g. sardines.
- o Preparation
 - o Fish or fishmeal (crushed or chopped 2 cm) into an airtight bucket or container.
 - o Mix Activated EM and molasses into (warm) water and pour the solution into the container.
 - o Close the container airtight, install breather pipe as with Activated EM if necessary (see diagram).
 - o Place the container into the sun. This is the only EM derivative to be placed into the sun for fermentation. This is done to especially encourage the photo-synthetic bacteria.
 - o Stir the brew regularly to release the gas.
- o Good EM-FF
 - o It is ready in 1 month.
 - o pH is between 6 and 7
 - o Spray in a dilution of 1:1 000-1 500. If it is too smelly mix with 25 % Activated EM just before spraying.
 - o EM FF can be stored for 6 months.
- o Use of EM FF
 - o Spray on plants at 1:500 to 1:1000
 - o 1:300 inoculation into the soil

How to make EM FCM

- o Materials
 - o 3 % good quality Activated EM
 - o 3 % pure liquid cane molasses
 - o Clean water
 - Borehole drinking water

- City water: containers with city water need to be left open in the sun for a day to get rid of the chlorine before being used.
- o Temperature 20 - 25 degrees Celsius is best (a range from 15 – 37 degrees Celsius is acceptable)
- o 20 % by volume chicken manure
- o 1 % by volume EM Bokashi

- o Preparation
 - o Put chicken manure into an airtight bucket or container.
 - o Add bran Bokashi.
 - o Mix EM and 3% molasses into (warm) water and pour the solution into the container.
 - o Close the container airtight, install breather pipe as with Activated EM if necessary (see diagram).
 - o Store the container away from the sun in a warm place (20- 35°C)
 - o Stir regularly to release the gas.

- o Good EM FCM
 - o It is ready in 1 - 2 weeks.
 - o Favourable pH is between 5 - 6
 - o Spray in a dilution of 1:1 000-1 500.
 - o EM FCM can be stored for 1 – 2 months.

- o Use of EM FCM
 - o Spray on plants at 1:500 to 1:1000
 - o 1:300 inoculation into the soil

How to make EM5 – Insect repellent

- o Materials
 - o 10 % good quality Activated EM
 - o 10 % natural grape vinegar (not spirit vinegar, which is derived from coal)
 - o 10 % pure liquid cane molasses
 - o 10 % Alcohol (above 40% alcohol content)
 - o 60 % Good clean water

- o Preparation
 - o Mix the molasses in warm water to dissolve completely.
 - o Add alcohol and vinegar to the molasses water and stir.
 - o Fill into the container
 - o Add Activated EM last
 - o Fill container with water, leave a little gap of air.
 - o Mix well
 - o Seal the container airtight and release the gas often or install breather pipe as with Activated EM (see diagram).

- o Good EM5
 - o When EM5 is ready the strong Molasses smell has disappeared and is a good blend with quite a strong alcohol smell.

- o EM5 takes a little longer to mature, between two and four weeks.
- o The pH is around 3.6
- o EM5 can be stored for 6 months.
- o Use of EM5
 - o Spray on plants at 1:500 to 1:1000
 - o Mix with EM 3-in-1 50/50 as preventative for insects
 - o Spray on animals (against tick, flea etc infestation) at a rate of 1 -10%

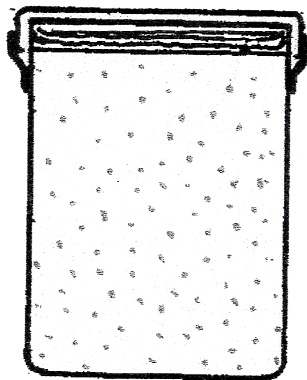
How to make EM Bokashi

There are many different kinds of Bokashi for various applications. Below is a recipe, which can be used universally, is simple and cheap to make. The liquid we use to mix into the bran varies because the moisture content of the bran also varies. The quantities below are therefore a guide.

In airtight container

a.	Type 1	Wheat or maize bran only	125L
b.	Type 2	Wheat or maize bran +Sunflower or soya oil cake	100L 25L

Little air space



Airtight seal

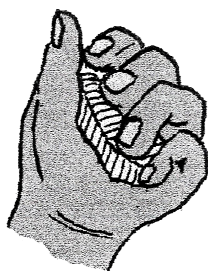
Then add: (Depending on moisture content)

Water	±30L
Molasses (1% of water volume)	300ml
M-EM(1% of water volume)	300ml

Store inside

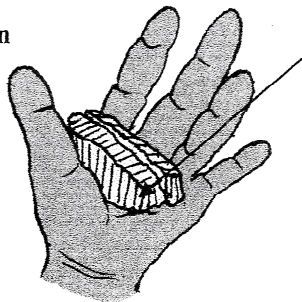
Place 3 layers of newspaper on top of the Bokashi to absorb excess moisture to prevent dew from forming, which can cause the Bokashi to rot

Hold



Suitable water volume

Open



Cracks form slowly but does not crumble down.

o Materials

- o 1 % good quality Activated EM
- o 1 % pure liquid cane molasses
- o About 30 % vol. good clean water
- o 125 – 150 % by volume of container wheaten bran, maize bran or any other available bran
- o A airtight sealing plastic bucket

- o Preparation
 - o Mix the molasses in warm water to dissolve completely.
 - o Add Activated EM
 - o Depending on quantity empty bran into a wheelbarrow or onto a clean concrete floor.
 - o Spray EM/molasses mix onto the bran, with a backpack sprayer or watering can. Mix bran thoroughly with hands or spades. Continue spraying, while another person mixes.
 - o To test if the moisture content is right (approx. 35%) you take a handful of the bran and squeeze in your hand. If liquid drips out, it is too wet. When you open your hand you want the 'sausage' to hold its form, open slightly, but not crumble apart. If it crumbles you need to add some more liquid.
 - o Fill the bran into the bucket in layers of about 20 cm at a time and then compact it with your fists or trample with your feet. You want to get all the air out. Bokashi is an anaerobic fermentation process.
 - o When the bucket is full cover with a few layers of newspaper, to absorb condensation water, and seal the lid well.

- o Good Bokashi
 - o Bokashi takes 4 to 8 weeks to mature.
 - o When it is ready, Bokashi has a sour smell, a bit like pickles.
 - o It can be stored up to 6 months.

- o Use of EM Bokashi
 - o Use as soil improver at 200 gr/sqm
 - o Feed: 200g/animal/day. Small animals 100- 150g/animal /day (between 1% – 3 %of their feed).

EM AND CLEANING DAMS AND RESERVOIRS

Introduction

EM can be used effectively to maintain and clean water in dams and reservoirs. Activated EM is added to the water at a rate of 1:1000. To support this inoculation of the water and to impact on the sludge build up on the floor, it is suggested to make EM Dumplings which are placed into the water at a rate of 1 dumpling per square meter floor area. Using the following recipe make as many dumplings as needed. Place each dumpling as an individual and don't stack them higher than two layers. The idea is for the ray fungi to completely encase the entire surface area of the dumpling. When the ray fungi have established themselves and the dumplings look like fur balls, they are ready to be used. They are now thrown into the water trying to position them at the rate of 1 dumpling per square meter.

Materials used:

- Dried sludge from the lake/dam/river/cess pit
- EM Bokashi
- (Bentonite) clay (if the sludge is not clayey enough already)
- Activated EM

Use the following quantities:

- 15 litre (1 bucket) of dried sludge
- 0.5 litre Bokashi
- 0.5 litre Bentonite (this is dependent on the clay content of the sludge and needs to be experimented with)
- 2 litre Activated EM (This is dependent on the moisture content of the sludge and needs to be experimented with. The final product must be as bread dough and must not be too runny!)

Everything is mixed thoroughly to a consistency, that allows making nice firm balls, the size of a tennis ball.

The balls are all placed where they will not be disturbed and covered with newspaper / hessian or a tarpaulin.

They are then ready to be placed into the pond/dam at about 1 ball per square metre.

Please contact us for specific challenges with polluted water bodies or any environmental pollution and we will work out a specific protocol for you!

EM FOR CATTLE

Introduction

Odour control is a major problem confronting confined livestock production systems. In cattle facilities some of the odour-causing compounds like ammonia are health hazards for people who work in the facility, for the animals, and are also a nuisance for the surrounding community. Research on the effects of ammonia on livestock show that it adversely affects growth rates, feed efficiency, reproduction, respiratory tract and increases susceptibility to disease.

Using Effective Microorganisms not only helps control odour, a regular maintenance plan with it also leads to a healthier operation that is more productive. The following guidelines are such a program to ensure your operation's success with Effective Microorganisms Treatment.

What we can expect

No bad odour, better food conversion ($\pm 10\%$), increased growth ($\pm 10\%$), better digestion, better fertility, few flies and other insect pests, no diarrhoea in calves, more even milk flow, increased milk production, drastic reduction in somatic cell count minimised incidences of mastitis, no foot rot, no stress, no antibiotics, improved general condition.

Methods of use

There are several ways in which Effective Microorganisms can be introduced into the system.

- 1) As a pro-biotic additive to drinking water and feed.
- 2) As spray to improve the environment of facilities.
- 3) As a treatment added to the stable bedding & manure handling process.
- 4) As skin and wound treatment
- 5) As treatment and prevention of foot rot

Instructions:

Effective Microorganisms are best applied regularly, so that a constant new supply of beneficial microbes are added to your environment.

- 1) As a pro-biotic to the drinking water add Effective Microorganisms at 1:1000. As a pro-biotic feed additive, add 1-5% EM Bokashi to the regular feed. In absence of EM Bokashi, Effective Microorganisms can be added over the feed at 100 ml Effective Microorganisms per meal. Alternatively use EM fermented silage (see below). To prevent diarrhoea/constipation in calves add 10 ml of Effective Microorganisms to every feed (when mixing with milk, add immediately before feeding to avoid curdling).
- 2) As a spray to improve the facilities' environment, mix 100 ml Effective Microorganisms with 500 ml of water and spray everywhere (over 10m²). To improve pasture growth, mix Effective Microorganisms 1:500 in water and spray ad lib.
- 3) As treatment for the stable waste, add Effective Microorganisms to the manure, bedding and other organic waste and make valuable compost. To prepare Effective Microorganisms for inoculating the materials mix 1 part Effective Microorganisms to 100 parts water. This solution is sprayed on the materials to achieve a final moisture content of 30-40%.
- 4) As a skin and hoof treatment (in cases of eczema, mange, odour etc). Mix 1 part Effective Microorganisms with 100 Parts water and sponge down the animal. Wash out wounds with a 1:10 mix three times/day and dry or apply as a poultice.
Do not apply at the same time as an antibiotic cream!
- 5) As prevention of hoof rot add Effective Microorganisms at 1% as a foot bath before animals enter milking parlour, or similar.

EM FOR POULTRY

Introduction

Odour control is a major problem confronting confined livestock production systems. In poultry facilities some of the odour-causing compounds like ammonia are health hazards for people who work in the facility, for the animals, and are also a nuisance for the surrounding community. Research on the effects of ammonia on poultry show that it adversely affects growth rates, feed efficiency, egg production, respiratory tract, susceptibility to Newcastle disease, incidence of airsacculitis, levels of *Mycoplasma gallisepticum*, and incidence of Keratoconjunctivitis.

EM beneficial microbes break up ammonia. As ammonia is an oxidative substance, it is putrefactive and supports the growth of pathogenic microbes. EM has an antioxidant effect on manure. This antioxidant effect will resist putrefaction, preventing noxious odours. In addition, the makeup of EM has also been shown to promote the growth of other beneficial microbes therefore suppressing the growth of pathogenic bacteria. Using EM not only helps control odour, a regular maintenance plan with it also leads to a healthier operation that is more productive. The following guidelines are such a program to ensure your operation's success with EM Treatment.

What we can expect

No bad odour, better food conversion ($\pm 10\%$, therefore more profit), increased growth ($\pm 10\%$), reduced mortality (below 2%), longer laying time and increased yield, few flies and other insect pests, no stress, no antibiotics.

Methods of use

There are four different ways in which EM inoculants can be introduced into the production system.

- 1) As a pro-biotic additive to drinking water.
- 2) As a pro-biotic feed additive.
- 3) As an additive to sanitation spray water for washing the facility.
- 4) As a treatment added to the waste handling process.

Instructions

EM is best applied regularly, so that a constant new supply of beneficial microbes are added to your system.

- 1) As a pro-biotic to the drinking water add EM at 1:1000. Be careful with nipple drinkers, since they can slime-up. In this case add EM every second day, so that the system can flush through with fresh water.
- 2) As a pro-biotic feed additive add 1-5% EM fermented feed or Bokashi to the regular feed. In absence of EM Bokashi, EM can be lightly sprayed over the feed at a 1:100 dilution.
- 3) As an additive to sanitation spray. Spray & wash all surfaces of the barn with a diluted solution of EM and water at 1:50, when empty.
Spray or top-dress EM onto litter (whether fresh or caked-out). Minimum EM to be used should be at 50 ml per square meter of barn. This calculated amount should be

diluted in just enough water to cover floors adequately. Be careful to not wet the birds, they might catch a cold in the wintertime.

4) As treatment for the poultry waste, add EM to the manure, bedding and other organic waste and make valuable compost.

To prepare EM for inoculating the materials, molasses is dissolved in water and EM is added to this solution. There is a final ratio of one part EM to one part molasses to 100 parts water. This solution is sprayed on the materials to achieve a final moisture content of 30-40%.

EM FOR PIGS

Introduction

Odour control is a major problem confronting confined livestock production systems. In pig facilities some of the odour-causing compounds like ammonia are health hazards for people who work in the facility, for the animals, and are also a nuisance for the surrounding community. Research on the effects of ammonia in animal production systems show that it adversely affects growth rates, feed efficiency, fertility respiratory tract. It also increases stress in the animals and susceptibility to numerous diseases. EM beneficial microbes break up ammonia. As ammonia is an oxidative substance, it is putrefactive and supports the growth of pathogenic microbes. EM has an antioxidant effect on manure. This antioxidant effect will resist putrefaction, preventing noxious odours. In addition, the makeup of EM has also been shown to promote the growth of other beneficial microbes therefore suppressing the growth of pathogenic bacteria. Using EM not only helps control odour, a regular maintenance plan with it also leads to a healthier operation that is more productive. The following guidelines are such a program to ensure your operation's success with EM Treatment.

What we can expect

No bad odour, low stress, better food conversion ($\pm 10\%$, therefore more profit), increased growth ($\pm 10\%$), better meat quality, improved birth rate, reduced mortality, few flies and other insect pests, reduced labour costs and no or minimal need for antibiotics.

Methods of use

There are four different ways in which EM inoculants can be introduced into the production system.

- 1) As a pro-biotic additive to drinking water.
- 2) As a pro-biotic feed additive.
- 3) As an additive to sanitation spray water for washing the facility.
- 4) As a treatment added to the waste handling process.

Instructions:

EM is best applied regularly, so that a constant new supply of beneficial microbes are added to your system.

- 1) As a pro-biotic to the drinking water add SAEM at 1:1000, continuously.
- 2) As a pro-biotic feed additive add 1-5% EM fermented feed or Bokashi to the regular feed. In absence of EM Bokashi, SAEM can be lightly sprayed over the feed at a 1:100 dilution.
- 3) As an additive to sanitation spray. Spray & wash all surfaces of the barn with a diluted solution of SAEM and water at 1:50. Pigs can also be sprayed at the same time, which they will enjoy, especially in summer. Ideally this is done daily at the beginning and can then be reduced to every second day and eventually twice per week. Your nose will tell you when to increase spraying again.
Spray SAEM onto litter (whether fresh or caked-out). Minimum SAEM to be used should be at 50 ml per square meter of barn. This calculated amount should be diluted in just enough water to cover floors adequately.
- 4) As treatment for the pig waste, add SAEM to the manure, bedding and other organic waste and make valuable compost.
SAEM solution is sprayed at 1:100 dilution on the materials to achieve a final moisture content of 30-40%.

EM FOR SHEEP

Introduction

Odour control is a major problem confronting confined livestock production systems. In livestock facilities some of the odour-causing compounds like ammonia are health hazards for people who work in the facility, for the animals, and are also a nuisance for the surrounding community. Research on the effects of ammonia in animal production systems show that it adversely affects growth rates, feed efficiency, fertility respiratory tract. It also increases stress in the animals and susceptibility to numerous diseases. EM beneficial microbes break up ammonia. As ammonia is an oxidative substance, it is putrefactive and supports the growth of pathogenic microbes. EM has an antioxidant effect on manure. This antioxidant effect will resist putrefaction, preventing noxious odours.

In addition, the makeup of EM has also been shown to promote the growth of other beneficial microbes therefore suppressing the growth of pathogenic bacteria. Using EM not only helps control odour, a regular maintenance plan with it also leads to a healthier operation that is more productive. The following guidelines are such a program to ensure your operation's success with EM Treatment.

What we can expect

No bad odour, low stress, better food conversion ($\pm 10\%$, therefore more profit), increased growth ($\pm 10\%$), more efficient digestion, better meat quality, better fertility, improved birth rate, reduced mortality, fewer flies and other insect pests, no diarrhoea in lambs, more even milk flow, increased milk production, drastic reduction in somatic cell count, minimised incidences of mastitis, no foot rot, less stress, improved general condition reduced labour costs and no or minimal need for antibiotics...

Methods of use:

There are several ways in which EM inoculants can be introduced into the production system.

- 1) As a pro-biotic additive to drinking water and ford additive.
- 2) As an additive to sanitation spray to improve the environment of the facility.
- 3) As a treatment added to the stable bedding & manure handling process.
- 4) As a skin and wound treatment
- 5) As a treatment and prevention of foot rot

Instructions:

SAEM is best applied regularly, so that a consistent new supply of beneficial microbes are added to the environment.

- 1) Add *SAEM* as a probiotic to the drinking water at 1:1000.
As a probiotic feed additive, add 1-5% Bokashi to the regular feed. In absence of Bokashi, *SAEM* can be added over the feed at 50 ml *SAEM* per meal. Alternatively use *SAEM* fermented silage (see separate fact sheet). To prevent diarrhoea/constipation in lambs add 10ml of *SAEM* to every feed (when mixing with milk, add immediately before feeding to avoid curdling).
- 2). As a spray to improve the facilities' environment, mix 100ml *SAEM* with 500ml of water and spray everywhere (over 10m²). To improve pasture growth, mix *SAEM* 1:500 in water and spray ad lib.
- 3) As treatment for the stable waste, add *SAEM* to the manure, bedding and other organic waste and make valuable compost.

To prepare *SAEM* for inoculating the waste materials, mix 1 part *SAEM* to 100 parts water. This solution is sprayed on the materials to achieve a final moisture content of 30-40%.

4) As a skin and hoof treatment (in cases of eczema, mange, odour etc. Mix 1 part *SAEM* with 100 Parts water and sponge down the animal. Wash out wounds with a 1:10 mix three times/day and dry or apply as a poultice. Do not apply at the same time as an antibiotic cream!

5) As prevention of hoof rot add *SAEM* at 1% as a foot bath before animals enter the holding yard, or similar.

EM FOR HORSES

Introduction

Odour control is a major problem confronting confined livestock production systems. In stable facilities some of the odour-causing compounds like ammonia are health hazards for people who work in the facility, for the animals, and are also a nuisance for the surrounding community. Research on the effects of ammonia on livestock show that it adversely affects growth rates, feed efficiency, reproduction, respiratory tract and increases susceptibility to disease.

Using Effective Microorganisms not only helps control odour, a regular maintenance plan with it also leads to a healthier operation that is more productive. The following guidelines are such a program to ensure your operation's success with Effective Microorganism Treatment.

What we can expect

No bad odour, better food conversion ($\pm 10\%$), increased growth ($\pm 10\%$), better digestion, few flies and other insect pests, no stress, no antibiotics, improved general condition...

Methods of use

The use of EM in horse husbandry fall into the following areas:

1. Bokashi or EM is added to the fodder ration and/or to the drinking water to stimulate the digestion in a beneficial way and improve food conversion.
2. The environment in stable and paddock is improved through the spraying of EM. This eliminates bad odour, suppresses harmful germs and introduces the beneficial microbes to steer the area (environment) into a fermentative environment.
3. Fodder conservation (hay & silage) is improved through the use of EM.
4. Stable bedding and manure are efficiently composted with the aid of EM, producing a valuable fertiliser for the farm and estate.
5. Topical application of EM for parasite/insect control as well as for dermatological conditions and wound dressings works very well.

Instructions:

Effective Microorganisms is best applied regularly, so that a constant new supply of beneficial microbes are added to your environment. When supplying it to the horses' diet, start with half the dose and build up to the recommended amount.

1) As a pro-biotic to the drinking water add Effective Microorganisms at 1:1000.

As a pro-biotic feed additive, add 1-5% EM Bokashi to the regular feed. In absence of EM Bokashi, Effective Microorganisms can be added over the feed at 20 ml per meal. This amount can also be administered neat into the horses' mouth.

2) As a spray to improve the stable environment, mix 100 ml Effective Microorganisms with 500 ml of water and spray everywhere (over 10m²). To improve paddock and pasture growth, mix Effective Microorganisms 1:500 in water and spray ad lib.

3) As treatment for the stable waste, add Effective Microorganisms to the manure, bedding and other organic waste and make valuable compost.

To prepare Effective Microorganisms for inoculating the materials mix 1 part Effective Microorganisms to 100 parts water. This solution is sprayed on the materials to achieve a final moisture content of 30-40%.

4) As a skin treatment (in cases of eczema, mange, odour etc. Mix 1 part Effective Microorganisms with 100 Parts water and sponge down the horse. Wash out wounds with a 1:10 mix three times/day and dry or apply as a poultice. Do not apply at the same time as an antibiotic cream!

Feeding:

In its original life in the wild the horse was in constant movement, preoccupied with continuous feeding. In this process it not only nourished itself, but instinctively ate particular plants that regulated bowel/intestinal movement and even had medicinal effects. With continuous domestication and the housing of horses in stables the feed became prescribed by us humans and the horse has come to not have free choice anymore. The fodder of stabled horses consists today primarily of concentrated feed (grains & legumes) and roughage (hay & straw). It is mostly administered in 2 to 3 rations per day, through which the intestines are for a short period strongly impacted upon. In between these times the intestines are for long periods empty, a condition that contradicts the construction and function of the horses intestines! This can call forth very easily all manner of illnesses, affecting stomach and intestines, which one commonly describes with the dreaded word colic. Logically one derives from this that as in it's life in the wild, the horse should be fed (obviously more time consuming) with smaller rations (4 - 6 or more), spread over the whole day.

Grass and hay form the basis of the horses nutrition

Fresh Green Grass

- Cut grass must not contain any poisonous plants
- It has to be fresh and can be stored only for a short period in a cool and airy space (max. 10 hours).
- Under no circumstances must it heat up and start fermenting.

Hay from good pastures

- Is a combination of a rich variety of grasses and herbs
- ideally is grown on a soil rich in limestone
- is mown towards the end of the flowering period
- is sun dried
- should come in lightly pressed bales or stored in dry and airy conditions
- should be fed earliest 3 months after harvest (maturation)
- has a green hue
- has a pleasant, fresh aroma

Making hay and EM

Hay is usually stored with a dry-matter content of 86 %. This means that there is a minimum of 14 % moisture left in the hay. In the process of baling or other storage a fermentation process takes place in the barn (ripening), which can be recognised by slight warming and sweating. If this process goes wrong, undesirable fungus grows which is recognised as dusty and has a mouldy smell.

This fermentation process when storing the hay can be beneficially influenced in introducing fermenting micro organisms contained in EM. In this case EM takes on the role of a starter culture.

Recommended use:

1 litre Activated EM neat per m³ hay

Concentrated feed

Grain feed, like oats, barley, maize and / or a combination of them expend above average energy and performance due to their high nutritional value.

This kind of feed did not form part of the natural diet of the horse in the wild, where it almost exclusively foraged on bulky roughage.

Since grain feed hardly contains fibres but has a very high nutritional value it must only be fed in a strict, individually adjusted dosage as a correct ration to avoid digestive disturbances or even illness. Overdose of concentrated feed and a simultaneous shortage of roughage disturb healthy bowel movements and can in combination with limited exercise lead to severe illnesses.

Mould in grains can lead to severe health defects.

Barley, oats but also bran of various grains are often infected with mycotoxins (mould poisons). In purchasing feed one must always go for the highest quality and check smell and coloration.

Mycotoxins in horse feed

More than 250 different fungi are known to produce mycotoxins. Mycotoxins are metabolic products from fungi that are poisonous in various degrees to man and animal.

Presently there are already more than 300 mycotoxins known to science.

The group of aflatoxins are generally an imported problem, since they are mainly found in oil containing seeds and nuts of tropical and subtropical origin. The aflatoxin B₁ is seen as the most dangerous one, containing extraordinary toxicity and already tiny amounts can lead to liver damage. It is also known as one of the strongest carcinogens. With respect to the animals' health, we can't dismiss the micotoxins that are formed by the field fungi of the genus fusarium. In view of their potency and the frequency of occurrence in our grains we have to consider them as mycotoxins with the greatest importance.

We can also find mouldy fungi in all silage. Blue mould (*P. roqueforti*) and Red mould (*monascus ruber*) are the most common moulds in silage.

Prevention with EM

It is possible to prevent possible mould fungi with the aid of EM. When making silage or hay for storage, EM is used. As supplementary feed Bokashi can be used. Through proper fermentation and the use of EM, the moulds are suppressed and their growth prevented. Very good and nutritious silage can be produced with the aid of EM. More information in this regard can be obtained from us.

As reports from all over the world show, EM can (as well as using it as silage inoculant) be administered directly into any feed. In this way we have direct influence on the microbial digestion.

Feeding examples:

The following shows, how EM can be used in the feeding of the horses.

FOALS	EM	BOKASHI FEED
from day 3	10 ml undiluted daily into the mouth	
With the beginning of feeding solid food	10 ml undiluted daily into the mouth	100 - 150 gr/day

As reported by many EM users, the administering of EM as above has a very good effect on the health and the growth of the foal.

HORSES	EM	BOKASHI FEED
Resting	2 X 10 ml undiluted daily into the mouth	200 gr/day
Working	2 X 10 ml undiluted daily into the mouth	500 gr/day

Alternatively and/or additionally EM can be added to the drinking water at a 1:1000 dilution.

It is also beneficial to spray the hay that is fed to the horses on a daily basis with EM.

EM use in the stable

Internationally EM is misted in regular intervals into the stables and has a very positive effect on the general well being and health of the animals and the stable environment. In spraying EM in the stables, we influence positively the microbial environment to a large extent. Harmful microbes and their putrefying effect (resulting in the development of harmful gases like ammonia, methane, H₂S etc.) will be controlled by the addition of EM.

Through this the quality of the air is improved immensely and insect occurrence reduced. Simultaneously EM ends up in the bedding and manure and through this improves their quality and the subsequent compost that is produced from it.

Amounts used and frequency of EM application

AREA	EM	WATER	TOTAL LIQUID	FREQUENCY OF APPLICATION
1 m ₂	10 ml	40 ml	50 ml	every third day
1 m ₂	25 ml	75 ml	100 ml	once a week
10 m ₂	100 ml	400 ml	500 ml	every third day

AREA	EM	WATER	TOTAL LIQUID	FREQUENCY OF APPLICATION
10 m ₂	250 ml	750 ml	1000 ml	once a week
100 m ₂	1000 ml	4000 ml	5000 ml	every third day
100 m ₂	2500 ml	7500 ml	10 litres	once a week
1000 m ₂	10 litres	40litres	50 litres	every third day
1000 m ₂	25litres	75 litres	100 litres	once a week

The frequency indicated above is during 'normal' times, i.e. once an EM program has been introduced and EM is regularly used in the stables and environment. For the first 4 weeks and in crisis times (often during the change of seasons) it is recommended that stables are sprayed on a daily basis.

Method:

To mist the EM throughout the stable a variety of methods can be used. We recommend the use of simple, low cost technologies.

Examples:

- In smaller stables the spraying of EM with a knapsack sprayer
- The use of a motorised (knapsack) spray for larger stables (Stihl, Solo, Kärcher). The advantage with motorised sprayers is that the walls and ceilings can also be sprayed quite easily.
- A permanent mist sprayer can be installed on the ceiling with irrigation piping and mister or butterfly nozzles as is used in horticulture.

EM use in the paddocks, arenas and pastures

To ensure a healthy environment in it's totality EM should also be used in the management of paddocks, arenas and pastures. Experience has shown that paddocks and pastures will become softer, will infiltrate and hold more water, thus ensuring better and denser grass growth of higher quality.

Method:

If pastures, paddocks and arenas are regularly irrigated, it is easiest to add EM into the irrigation reservoir or tank (if it is dedicated for this purpose only) or introduce it through a dosing mechanism, e.g. Dosatron. or header tank The dilution rate would be 1:1000.

When fertilising with your own EM compost (applied in spring and (if irrigation available) autumn) you will also add the EM's to the soil environment. EM compost should be applied at a minimum of 30 ton/ha. It is better to apply this rate to a smaller piece than spread the amount over a larger area.

EM use for bedding and manure management

The bedding including the manure and urine contained within it can form the basis for making a valuable fertiliser through composting.

Depending on the ratios and the materials used for the bedding the composting process will take from between 4 to 10 months. Water content in the compost will also impact on the duration and quality of the end result.

Method:

There are a number of factors to successfully making high value compost. It is important that the ratio of carbon (bedding, hay, straw etc.) to nitrogen (manure, urine, greens etc.) is balanced as far as possible at $\pm 20:1$. This however can not be done intellectually and is a skill that is learned over time.

Water is an other very valuable input, of which one needs plenty. We can use up to 1000 litres of water for 1 cubic meter of compost material, especially when one uses highly ligneous materials like wood shavings as bedding!

Thirdly, to steer the compost into a beneficial process quickly, eliminate all smells and introduce multitudes of beneficial microbes we add Activated EM at 8 to 10 litres per cubic meter!

We are happy to do a short composting workshop with you/your staff and monitor the process for a while until you are confident.

EM use for conditions of the skin and wound management

EM has been successfully used to treat all kinds of skin conditions, from eczema and mange to wounds, hoof rot and serious injuries. We have to understand that the health of the skin depends on a balanced beneficial flora and fauna of microbes. So usually a disturbance of our biggest organ, the skin, is a microbial disturbance.

Method:

For general washes, mange, eczema dilute Activated EM at 1:100 and sponge down the horse.

For wound treatment wash out the wound with a 10% Activated EM solution, three times a day, let it dry.

For an insect repellent use EM 5 at 1:100 dilutions. For specialised treatment repellent herbs like khakibos, lavender, rue etc. can be added to the EM brewing process. Alternatively the respective etheric oils can be added before application.

EM FOR MAKING SILAGE

Introduction

Research at the University of Wageningen, the Netherlands, and practical experience in the Netherlands, South Africa, Germany and other countries has shown the effectiveness of using EM as a very effective means to silage grass and green grains for animal fodder.

What we can expect

The use of EM has a significant influence on the rapid lowering of the pH. Within 6 days we can already expect a pH of 5.5 and after 2 months the pH is at around 4.3. This is as a result of high numbers of lactic acid bacteria in EM and their rapid multiplication in those conditions. The speed of fermentation is important so as not to allow unwanted microorganisms to steer the fermentation into putrefaction.

A significant improvement in silage quality is also noted in its aerobic stability, i.e. the quality of silage decreases rapidly when it is left in the open in aerobic conditions. Non-EM treated silage usually starts heating up and thus breaking down after 60 hours in the air. EM silage however proved stable and showed no sign of breakdown or reduced quality after 3 weeks in the open!

Instructions

- 1) EM is mixed with the grass/grain that has been slightly dried (50% dry matter content).
- 2) For 1m³ grass silage add 1 litre EM For Maize silage use 1.5 – 2 litres EM per 1m³. The EM is best sprayed finely over the material to be preserved and mixed in thoroughly.
- 3) It is then compacted as usual and stored anaerobically until used (minimum 6 weeks).

EM FOR TURF GRASS MANAGEMENT

Introduction

There is growing public demand for natural turf management that does not compromise the health of people and the environment. Effective Microorganisms represents a viable natural solution that offers a safe and effective alternative to harmful agro-chemicals. EM is quickly becoming an important natural tool for the health of residential lawns, city parks, schools, and golf courses.

EM contains beneficial microorganisms that improve soil structure, drainage and water retention of the soil's rhizosphere (root zone). EM will significantly improve turf quality during the months of extreme heat and moisture when disease pressure is greatest.

A Summary of what we can expect

- Effective Microorganisms serves as a catalyst to naturally detoxify and enrich the topsoils—which increases plant growth, yield and overall nutritional quality.
- Improvement of soil quality substantially reduces the growth of weeds and herbivore insects, thus gradually eliminating the need for toxic herbicides, pesticides, and synthetic fertilisers.
- Effective Microorganisms promotes photosynthesis and strengthens the vigour of plants, thus increasing their ability to withstand drought, floods, and temperature extremes.
- Effective Microorganisms naturally remediates harmful substances—such as heavy metals, salinisation, and agro-chemicals—while restoring the microbial diversity of the topsoils.
- Effective Microorganisms increases soil temperature through microbial activity, which enables greater cultivation in colder regions.
- Effective Microorganisms improves soil aggregation, permeability, and water holding capacity—thus reducing overall water usage.
- Effective Microorganisms helps prevent the erosion of fertile topsoils—and can even convert desert and sodic environments into arable land.
- Detoxifies, conserves, and improves the overall quality of water and the runoff tributaries.
- Effective Microorganisms has proved very effective for treating fungal diseases on Golf greens such as *Sclerotinia homoeocarpa* and others.
- The so-called 'thatch eater' microorganisms (*Actinomycetes* spp.) effectively help to digest the black thatch layer often encountered under greens and turn them into humic substances, useful for healthy growth.

Methods of use

- Apply Effective Microorganisms with a hose-end sprayer, backpack sprayer, or inject into the irrigation system about every 7-10 days throughout the growing season at a dilution of 1:200
- It is recommended to use organic fertilisers in combination with Effective Microorganisms which provide a natural food-base for the soil and microbes.
- Use a "mulching mower" to chop and redeposit the grass clipping. Spray Effective Microorganisms onto the turf after mowing. This enables the clippings to rapidly breakdown into stable organic matter for the soil. Organic matter particles provides a home for the microorganisms to establish in the soil.