EM Technology and Organic Matter Amendments in the Tropics

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Abstract

When effective microorganisms are applied to soil there occurs a significant soil improvement and better yields in the first year. However, in the following years, soil structure breaks down and the soils become very compact and hard. EM has to be used together with organic matter to warrant success. An experiment was covered with mulch of chipped branches at five levels : none, 6.500, 13,500, 19.500 and 26.000 kg/ha fresh material. 1.1 liter/ha EM was sprayed on it which corresponds to a solution of 1:200. As the season was extremely rainy mulch broke down rapidly but the soil kept its silky touch and porous structure. The most adequate amount of organic matter was 13.500 kg/ha of fresh material. With less organic matter, EM improved soil structure only in the upper layer (0-5cm). With 13.500 kg/ha soil structure was better and yields were the highest. With more organic mater, soil structure improved less, probably because the breakdown of organic matter was made partially of common soil microorganisms. It was concluded that for each milliliter EM, 12 to 14 kg of organic matter (fresh) or 3.5 to 4.0 kg of straw were needed to improve soil and yield also in further years.

Introduction

For six years, EM applications to rice, maize, field beans and vegetables have always increased yield in the first year between 12 to 68 percent according to the soil and crop. Soil structure also improved significantly changing bulk density, in the middle, from 1.2 g/cm^3 to 0.4 g/cm^3 and sometimes from 1.5 to 0.25 g/cm^2 in the upper soil layer. Between 5-10 cm of depth changes from 2.0 g/cm^3 to 1.0 g/cm^3 occurred.

However in the second year, general soil improvement could not be maintained in our soils. In some very good Brazilian soils, sometimes the positive effect lasted for 2 years and, in temperate climate zones, as central Europe, it could continue for three years. But then, the breakdown of soil structure always happened (Primavesi, 1993). Experiments in Sri Lanka and Malaysia (Sangakkara, 1993 and Shariffudin et al 1993) always were made with organic matter. They used as well straw, compost or FYM. Both emphasize the use of organic matter together with EM to improve plant health and soil structure.

In a field bean test, the highest yield was obtained with 14 t/ha of maize straw to the soil (Primavesi, 1993). This seems to mean that EM needs organic matter to work well. This does not seem so strange as EM is a combination of different effective microorganisms as lactobacteria, actinomycetes and yeast, beside photosynthetic bacteria, which need organic matter for their life. This is decomposition of organic material to its original substances: CO_2, water and energy, releasing the minerals (Primavesi, 1997).

If there is little organic matter in the soil, EM will consume it and provoke, consequently, a breakdown of soil structure and its porous system. This experiment was made, not only by Brazilian farmers but also by European ones. This was the reason for this experiment, to verify the necessary amount of organic matter to maintain the beneficial effect of EM on soils and crops.

Materials and Methods

Experiment was conducted during the summer 1996-97 which was an extremely rainy season. The textural and chemical composition of the soil are given in Table 1 while the bulk density at different depths ranged from 1.4 to 2.4 of cm^3 (Table 2).

Plots were 2.0 x 2.0m with a distance of 30 cm between them. Chipped tree branches up to 2.5cm of diameter were used as organic matter including all their leaves (Caron, 1994). Chipped branches were mulched at the rate of 0,6500, 13500, 19500, and 26000 kg/ha (Table 3). The average humidity of the material was 65 percent. As maize straw in field conditions has an average of 18-20

percent, it was taken as basis for dry matter calculation.

Table 1. Red-Yellow Podsolic Soil Analysis Indicating its Texture and Chemical Composition

Clay	Silt	Sand	pH $CaC1_2$	P μg/cm^3	K (*)	Ca (*)	Mg (*)	H-A l (*)	CEC (*)	V
18%	17%	65%	6.1	28	0.27	3.2	1.2	1.5	6.2	76%

(*) moles per charge of unit mass

Table 2. Bulk Density at Different Depths made by Soil Penetrometer

Soil Depth (cm)	g/cm^3
0-5	1.4
5-10	1.6
10-20	2.4
20-30	2.1

Table 3. Treatments and Quantities of Dry and Fresh Matter

Treatment Number	Dry Matter Kg/4m^2	Fresh Material Kg/4m^2	Fresh Material Corresponds kg/ha
1	Test	----	----
2	0.8	2.6	6.500
3	1.2	3.9	13.500
4	2.4	7.8	19.500
5	3.2	10.4	26.000

A well-moistened soil was covered by fresh organic matter like mulch. It was not turned over. EM was evenly sprayed over the whole area using 1.1 liter EM/ha diluting stock solution 200 times. As it was an extremely wet season, organic matter broke down rapidly. All plots were planted afterwards with field beans, which received two more sprays of EM when the plants were 3 and 5 weeks old with a dilution of stock solution up to 5.000 times.

Results

All EM-treated soils were soft. Soil structure was better in plots of treatment 3 (Table 4). A corresponding yield advantage was also obtained (Table 5).

Table 4. Bulk Density of Treatments at Different Soil Depths

Soil Depth (cm)	Bulk Density Treatments				
Treatment	1	2	3	4	5
0-5	1.4	0.80	0.28	0.30	0.70
5-10	1.6	2.00	0.80	1.00	1.25
10-20	2.40	2.25	1.20	1.55	1.90
20-30	2.10	2.20	2.20	2.30	2.30

Table 5. Yield of Beans in Different Treatments

Treatment Number	Bean Yield (g/plot)	Kg/ha
1	300	900
2	472	1,180
3	742	1,850
4	652	1,630
5	564	1,410

Conclusion

It may be concluded that the effective use of EM depends on an acceptable level of organic matter in soil. If there is more organic matter EM cannot ferment everything and other soil bacteria decompose it, which does not have the same effect as the effective microorganisms. If there is a lack of organic matter, EM consumes everything in a short time and may induce a breakdown of the porous soil structure. This means soil compaction and lower yields. Thus, EM must be used according to the amount of organic matter applied to the soil.

In this experiment, higher levels of organic matter improved less soils structure and yield when the same amount of EM was used. This suggests that organic matter and EM must exist in a certain proportion which, in our case, was 12 to 14 kg of fresh organic matter for each milliliter of EM or 3.5 to 4.0 kg of dry matter for each milliliter of EM. It seems that higher levels of EM applied to the soil as it contains organic matter, will not be advantageous.

References

Caron, C. 1994. Ramal Chipped Wood : A gold mine for regenerating soils. 10th IFOAM Conference, Lincolin University, New Zealand, Abstr. Pg. 54.

Primavesi, A., 1993. Effect of EM on the growth and yield of rice and beans. Proc. 3rd. International Conference on Kyusei Nature Farming. USDA – ARS/USAI, Beltsville, Maryland. USA.

Primavesi, A. 1997. Agroecologia, Nobel, Sao Paulo, Brazil

Sangakkara, U.R., 1993. Research on the technology of effective microorganisms in Sri Lanka. Proc. 3rd International Conference on Kyusei Nature Farming. USDA- ARS/USAID, Beltsville, Maryland, USA.

Sharifuddin, H.A.H., M.F. Shabuddin, A.R. Anwar, A.R. Zaharah and J. Samy. 1993. Nature Farming Research in Malaysia. Effect of organic amendments and EM on crop production,. Proc.3rd International Conference on Kyusei Nature Farming. USDA – ARS/USAID, Beltsville, Maryland, USA.