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IMPACT OF PADDY STRAW ENRICHMENTS ON ORGANIC CARBON CONTENT IN SANDY REGOSOL

S. Heerthiha, [124] and P. Premanandarajah, [225]

[1,2]*Department of Agric. Chemistry, Faculty of Agriculture, Eastern University, Sri Lanka.*

INTRODUCTION

Sandy regosol is one of the soil groups existing in Eastern Province, Sri Lanka. They are sandy in nature and have lower cation exchange capacity, because the coarse textured soils are low in both clay and humus content. Organic manures are a good source of organic matter. Among the crop residues, paddy straw is the most available organic material in Sri Lanka. Due to its high C:N ratio and slow decomposition rate, paddy straw needs more attention to increase their efficient use in Agriculture. Enrichment of paddy straw with other materials which enhance the decomposition of paddy straw may be useful practice in their efficient soil management.

Effective microorganisms (EM) is a liquid microbial inoculant that contains an assorted culture of beneficial fertilizer without fermentative microorganism such as lactic acid bacteria (*Lactobacillus Spp*), yeast (*Saccharomyces spp*), photosynthetic bacteria (*Rhodopseudomonas spp*), actinomycetes and fermenting fungi (Takashi Kyan *et al.*, 1999). These beneficial organisms have also been ascribed with the ability to encourage the mineralization of soil organic matter, which is the main mechanism through which EM could benefit soil health and plant nutrition (Piyadasa, 1995). Plants with lower C:N ratio is usually considered to decompose quickly than those with higher C:N ratio. *Gliricidia* could be attributed to the improvement of the rhizosphere by the added organic matter, especially those with a lower C: N ratio (Graves *et al.*, 2004). The present study was undertaken to find out the effect of paddy straw enrichments with *Gliricidia* and EM on organic carbon content in sandy regosol.

METHODOLOGY

The laboratory experiment was conducted at Eastern University, Sri Lanka which is located in the low country, dry zone of Sri Lanka. The soil used in this study was sandy regosol (pH 6.9, C 0.47%, N 0.0356%). Three organic materials used: paddy straw (C:N ratio 63:1, N 0.672%) , EM treated paddy straw (N 0.88%) and *Gliricidia* (N 4.1%).

EM treated paddy straw

EM extended solution was prepared by mixing five litres of EM stock solution and five litres of molasses in 100 litres of water. This mixture was kept in a closed container for 10 days. After that, this extended EM solution was added to paddy straw and mixed thoroughly. EM treated paddy straw was kept in an airtight bag. It was ready to use when it had a sweet fermented smell and white filamentous fungi on the surface.

Ten Kg of air dried and sieved (2 mm mesh sieve) soil was filled into black polythene bag. The treatments were: sole application of paddy straw (51.64 g), enrichment of paddy straw with effective microorganisms (EM) (39.43 g EM treated paddy straw) and enrichment of paddy straw with *Gliricidia* (4.18 g *Giricidia* / 25.82 g paddy straw) all on equal nitrogen basis at the rate of 0.347g N/10 kg soil. Four treatments including control were replicated five times in a completely randomized design.

[24] Correspondences should be addressed to Ms.S.Heerthiha, Department of Agric. Chemistry, Faculty of Agriculture, Eastern University Sri Lanka. (heerth_s@yahoo.com).

[25] Correspondences should be addressed to Dr. (Mrs).P. Premanandarajah, Department of Agric. Chemistry, Faculty of Agriculture, Eastern University Sri Lanka.(puni_prem@yahoo.com)

The treatments were incubated for 10 weeks and kept moist during the incubation. The soil analysis was carried out to measure soil organic carbon content by Chromic acid wet digestion (Walkley and Black method, 1934) at 2 week intervals. Data were analyzed using SAS statistical package and treatment means were separated by Duncan's multiple range tests.

RESULTS AND DISCUSSION

Organic carbon content (%) in soil

Table: 1 Effect of organic enrichments on organic carbon content of soil

Organic enrichments	Organic Carbon Content (%)		
	2^{nd} week	6^{th} week	10^{th} week
Paddy straw	1.52^{a}	1.11^{a}	0.87^{a}
EM treated paddy straw	1.04^{d}	0.80^{e}	0.68^{b}
Paddy Straw + *Gliricidia*	1.25^{b}	0.92^{c}	0.60^{d}
Control	0.43^{f}	0.36^{f}	0.34^{g}

Means followed by the same letter within a column are not significantly different according to the Duncan multiple range test at 5% level.

The results showed that there was significant influence of added organic sources on organic carbon content of soil at all three stages of incubation as P value is less than 0.05.

The results indicated that the soil received paddy straw solely and its combination with EM and *Gliricidia* recorded a higher organic carbon content than control. This indicated that the application of organic fertilizers increased the organic carbon content of the soil. This was supported by Nakhro and Dkhar, (2010). The higher organic carbon content might be due to higher organic matter content in organic amendments (Bibhuti and Dkhar, 2011).

Among the treatments of soil amended with paddy straw solely and with combination of *Gliricidia* and EM, the highest organic C content recorded in the soil received sole application of paddy straw at all three stages of incubation. This may be due to high non labile carbon fraction and slow decomposition rate of paddy straw (higher fiber, lignin content). This was supported by FAO, (1977). In paddy straw enrichments, the soil organic carbon content was lower due to rapid microbial decay of organic matter in soil because of enriching materials. This indicated that the addition of enriching materials (EM and *Gliricidia*) along with paddy enhanced carbon mineralization.

Due to the rapid decomposition of *Gliricidia* (low C: N ratio), soil amended with paddy straw + *Gliricidia* recorded significantly lower values of soil organic carbon content than soil received paddy straw solely. Goyal *et al.*, (1999) indicated that the addition of organic matter to soil was higher by wheat straw (high C:N ratio) than green manure (low C:N ratio).

It is also indicated that EM treated paddy straw amended soil recorded least value at 2^{nd} week of incubation. This may be due to the effect of EM on degradation of recalcitrant carbon fraction of straw. This was confirmed by Fatunbi and Ncube, (2009). But at the end of incubation, EM treated paddy straw recorded higher value of organic carbon than soil amended with paddy straw + *Gliricidia.* This may be due to higher mass of paddy straw applied in EM treatment than *Gliricidia.* Addition of EM to the straw greatly reduced the organic carbon content than other treatments at initial stage of incubation. This may be due to the pretreatment of EM with paddy straw.

CONCLUSIONS

Results indicated that the soil organic carbon content was influenced by paddy straw and paddy straw enrichments. Enrichment of paddy straw reduced the soil organic carbon content than sole application of paddy straw. Among the enrichments, soil organic carbon content was higher in *Gliricidia* treatment than EM treatment at 2nd and 6th week of incubation, but at 10th week of incubation it was higher in EM treatment.

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