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EFFECT OF ORGANIC AND INORGANIC AMENDMENDS ON CO_2 EVOLUTION AND RATE OF DECOMPOSITION OF COIR DUST

A fresh organic matter when added to the soil invariably undergoes decomposition to yield carbon dioxide as its major product. The rate of degradation of organic material depends largely on its chemical composition. Usually organic matter with higher nitrogen content and narrow C/N ratio undergoes faster decomposition than the one with poor nitrogen content. The addition of excess nitrogen to the organic residues with wider C/N ratio increased their rate of decomposition and CO_2 evolution (Pernas, 1975). Binger and Patil (1980) reported that the addition of nitrogen for narrowing down the original C/N ratio of wheat straw resulted in liberating high amount of CO_2. Further, incorporation of P as rock-phosphate accelerated the rate of carbon dioxide evolution. The maximum amount of carbon dioxide was evolved during the first week followed by the second week and reduced later on. Tester (1988) used carbon dioxide evolution as an index to study the effect of microorganisms on the decomposition added residues to the soil. The rate of decomposition of organic residues as measured by carbon dioxide evolution was influenced by the nitrogen content of crop residues (Janzen and Kucey, 1988)

Coir dust is an important byproduct of coir industry, which is very light, highly compressive and having high water holding capacity. Coir dust is also being used for mulching and for making potting mixtures. This high carbon source could be made use of in manufacturing high value compost. However, it is a lignaceous material with high carbon and wide C/N ratio. Because of this, it undergoes slow decomposition in the soil.

In the present study, an attempt has been made making use of various organic and inorganic amendments to study their effect on the rate of decomposition of coir dust. Six treatment combinations were used. Only coir dust and *Pleurotus* was considered as a check to compare the influence of organic and inorganic additives on the decomposition of coir dust. The inorganic amendments used were urea and phosphate rock (Gafsaphos) to get a concentration of 2% N and P on w/w basis. In one of the treatments, cow dung was used mainly to serve as an inoculum for cellulose degradation. Micronutrients like Zn, Fe, Mn and Cu were incorporated as their sulphate salts at the rate of 200 ppm and Cu at the rate of 20 ppm. Inoculation with *Pleurotus* at the rate of 1 g kg^{-1} was given for all the treatments. Accordingly, there were six treatments as follows:

C1 Coir dust + *Pleurotus*

C2 Coir dust + *Pleurotus* + urea

C3 Coir dust + *Pleurotus* + urea + rock phosphate

C4 Coir dust + *Pleurotus* + urea + rock phosphate + micronutrient

C5 Coir dust + *Pleurotus* + cow dung (20%)

C6 Coir dust + *Pleurotus* + poultry manure (20%)

The materials for each treatment combination were mixed on polythene sheet and transferred to a series of one-litre flat-bottomed flasks. The contents of the flasks were brought to optimum moisture conditions. The flasks were closed with corks with a hook at the bottom and sealed. Twenty ml of standard NaOH was taken in a 50 ml glass tubes and hung in hooks to trap the liberated carbon dioxide. The flasks were incubated at 28 °C. The CO_2 trapped in NaOH was determined at daily intervals up to 7 days and thereafter on alternate days. After 21 days, the observations taken once in 3 days up to the end of 120 days. On the days of observations, the alkali traps were removed and the flasks were kept open for 5 min to prevent complete anaerobic situations. The loss of carbon dioxide during this exposure time is ignored in all the treatments. After 5 min, another trap with 20 ml alkali was hung and the flasks were sealed. To estimate the observed carbon dioxide, the alkali in the glass traps were treated with 0.5 g barium chloride and titrated against standard H_2SO_4 as per the procedure of Pramer and Schmidt (1964).

According to the data in Table 1 on rate of carbondioxide evolution, the decomposition took place rapidly up to the third week and

Table 1. The rate of CO_2 evolution [mg (100g)$^{-1}$ x 10^2 day^{-1})] and the per cent carbon loss as CO_2 from different treatments

Treatments	Phase 1 (Weeks 1-3)	Phase 2 (Weeks 4-7)	Phase 3 (Weeks 8-17)	% C evolved as CO_2 (After 120 days)
C_1	1.11	0.61	0.28	9.95
C_2	1.19	0.79	0.34	14.08
C_3	2.01	0.82	0.31	14.21
C_4	2.19	0.69	0.37	14.95
C_5	2.00	0.72	0.38	12.75
C_6	2.06	0.71	0.22	11.76
F test	*	*	*	*
CD (0.05)	0.182	0.021	0.021	1.685
Average	1.88	0.72	0.31	

then slowed down. Based on the rate of decomposition, three phases could be identified for coir dust based composting mixtures. The first phase had a rate of decomposition ranging 1.11 to 2.19, the second phase 0.61 to 0.82 and the third phase 0.22 to 0.38 mg 100g^{-1} x 10^2 day^{-1}. The average rates of decomposition for three phases were 1.88, 0.72 and 0.31 mg 100g^{-1} x 10^2 day^{-1}.respectively. The differences in the rate of decomposition among the treatments were more during the phase I and later the differences were narrowed down, though significant differences were observed among the treatments.

Incorporation of additives like N, RP and cow dung accelerated the rate of decomposition. Addition of P as RP with N increased the decomposition rate compared to only N. The incorporation of cow dung hastened the decomposition compared to control. The treatment C_4 with N + RP + micronutrients emerged as the best system which resulted in maximum loss of carbon dioxide followed by C_3 and C_2. In C_5 where cow dung was incorporated, the rate of decomposition was found to be higher during second and third phases, though the percent carbon loss as carbon di oxide was lower than in C_3 and C_4. This may be due to the extra carbon added through cow dung, which resulted in more total carbon in the decomposing system.

It could be concluded from this study that incorporation of only *Pleurotus* is not sufficient to get he optimum rate of decomposition of coir dust. Along with *Pleurotus* other additives like N, P and micronutrients would enhance the decomposition resulting in higher carbon loss. Incorporation of cow dung accelerates the rate of degradation over only *Pleurotus* incorporation.

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REFERENCES

Bangar, S.G and Patil, P.L. 1980. Effect of C:N ratio and phosphatic fertilizers on decomposition of wheat straw. *J. Indian Soc. Soil Sci.* 28: 543-546

Janzen, H. H and Kucey, R.M.N. 1988. C, N and S mineralization of crop residues as influenced by crop species and nutrient regime. *Pl. Soil* 106: 35–341

Pernas, H. 1975. Model for decomposition of organic matter by microorganisms. *Soil Biol . Biochem.* 7: 161-169

Pramer, D and Schmidt, E.L. 1964. *Experimental Soil Microbiology,* Burgers Publishing Co., Mineapolis, Minn., pp.107

Tester, C.F. 1988. Role of soil and residue microorganisms in determining the extent of residue decomposition in soil. *Soil Biol. Biochem.*20: 915-919