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MICROBIOLOGICAL AND BIOCHEMICAL CHANGES DURING THE COMPOSTING OF OIL PALM EMPTY-FRUIT-BUNCHES. EFFECT OF NITROGEN SUPPLEMENTATION ON THE SUBSTRATE

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Abstract

The composting of oil palm empty-fruit-bunches and of oil palm empty-fruit-bunches in supplementation with either goat dung, cow dung or chicken manure differed in the resulting C:N ratios. The initial C:N ratios (52:1, 35:1, 48:1, 47:1) for the four compost heaps were significantly reduced to 24:1, 14:1, 18:1 and 12:1, respectively, after 60 days of composting, resulting in the production of a stable humus that is suitable for crop production. A temperature of 70°C was maintained for 3 days at the onset of composting. Both mesophilic and thermophilic bacteria showed consistent activity throughout the process, whereas fungal activity was completely suppressed during the peak heating phase. The rate of utilization of cellulosic material showed a positive correlation with the increase in the nitrogen content of the compost.

Key words: Oil palms, empty-fruit-bunches, manure additions, compost, cellulose, carbon:nitrogen, microorganisms.

INTRODUCTION

The Malaysian palm oil industry generated 1·16 million tonnes of empty-fruit-bunches (EFB) in 1985 alone, the volume predicted to increase to 2·16 million tonnes by 2000 (Ministry of Primary Industries, Malaysia, 1991). Mulching currently accounts for only a fraction of the EFB that are discarded; these are normally burnt in incinerators for the ash as fertilizer. Currently there is much interest in utilizing palm oil waste in general (Thambirajah & Kuthubutheen, 1989). Composting has been suggested as an alternative to incineration of the waste as the process converts the waste, which is essentially organic in nature, into a humus that is suitable for crop production (Gomez & Park, 1983; Gray *et al.*, 1971). In composting, the higher-plant material breaks down under the influence of aerobic thermophilic microorganisms present in the waste to a material rich in organic nutrients.

On one hand, the EFB component of palm-oil waste presents particular difficulties both in its transportation and in its incineration, owing to its extensive bulk. On the other hand, EFB contain a high proportion of cellulosic matter which is easily decomposed by a combination of physical, chemical and biological processes. The bunch consists of 70% moisture and 30% solids; of which holocellulose accounts for 65·5%, lignin 21·2%, ash 3·5%, hot-water-soluble substances 5·6% and alcohol–benzene solubles 4·1% (Husin *et al.*, 1985). In an extension of an earlier study (Thambirajah & Kuthubutheen, 1989), on the composting of palm press fibre, we report in this paper the results of a similar study on EFB.

METHODS

Materials

Oil palm empty-fruit-bunches were shredded into loose fibrous material by using a shredder manufactured by B & W Engineering, Angel Drove, Ely, Camb. (Serial No. R/N 30/12). Goat dung, cow dung and chicken manure (poultry broiler floor litter) were collected from the research farm of the Institute of Advanced Studies.

Compost

Four heaps were prepared as follows: the first (Heap 1) had 90 kg EFB, the second (Heap 2) 90 kg EFB and 25 kg goat dung, the third (Heap 3) 90 kg EFB and 25 kg cow dung and the fourth (Heap 4) 90 kg EFB and 25 kg chicken manure (broiler floor litter). Water was added to each of the heaps to a final moisture content of 65% w/w. The heaps were turned once every week for 8 weeks. However, during the first week the heaps were turned on the third

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