INFLUENCE OF EFFECTIVE MICROORGANISMS (EM) IN THE COMPOSTING PROSESS OF RICE STRAW

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i. Introduction

Rice (*Oryza sativa*) is an important crop in many areas of the world. In Malaysia it is our main source of carbohydrate and its cover about 10% of total plantation area. Beside producing rice seed, it also produces a large amount of waste by-product and one of them is rice straw residue. It its estimated that from 700,000 hectare of rice plantation in Malaysia, it will produce 2 metric ton of rice straw every planting season (BERNAMA, 2009). It is imperative to find out an effective approaches to reuse the wastes and minimize pollution associated with them. An attractive alternative to recycling such waste is through composting. Composting is a process of stabilizing organic wastes through the degradation of biodegradable components by microbial communities under controlled conditions. Composting has been widely used for converting organic waste into relatively stable products for use as fertilizer or soil amendment. But traditional methods used a lot of labor power and consumed time. To improve decomposition rate of rice straw residue, EM solution will be apply to this organic waste. The role of EM in environmental management is significant importance. This microbial solution, which was originally developed for nature or organic farming systems, was further expanded to overcome environmental issues, thereby facilitating the reuse of most wastes. The technology of EM was develop during the 1970s by Tiruo Higa, Professor at the University of Ryukus, Okinawa, Japan (Sangakkara 2002). EM is a mixture of groups of organisms that has a reviving action on humans, animals and the natural environment (Higa, 1995) and also been described as a multi-culture of coexisting anaerobic and aerobic beneficial microorganism. Studies have suggested that EM may have a number of application including agriculture, livestock, gardening and landscaping, composting, bioremediation, cleaning septic-tank, alga control and household uses (Higa & Chinen, 1998). Application of EM supposedly leads to increases in the microbial biodiversity of soils which enhances their quality and the growth, yield, and quality of crops (Higa Parr, 1994). Beside all of the proclamation on the effect of EM, lot of research must be done to identify its effect on different type of medium such as rice straw. The potential effect for increases yield, improvements of soil structure are not known. Nevertheless EM is widely used in Asian countries in agriculture sector as an alternative way to improve their agriculture production.

This study is based on hypothesis that the application of EM on rice straw will increase the microbial activity thus increases the composting rate. It also

increases mineralization processes of through the enhanced microbial colonization and activity. It was further hypothesized that the EM Bokashi increases growth of rice plants. To test these hypotheses, compost of rice straw residues was produced with applications of EM and compared to control (water) which allowed the differences between the effects of added living organisms and pure substrate effects to be distinguished. The produced compost variants were then applied to rice plants in a pot experiment.

ii. Problem Statement & Significance of Study

Agriculture waste are one of the waste that usually not managed well by farmers. The options for the disposition of rice straw are limited by the great bulk of material, slow degradation in the soil, harboring of rice stem diseases, and high mineral content. Serious environmental pollution has been caused due to lack of cost effective approaches to reuse the waste and minimize pollution associated with them. This residue is usually burnt in the field after harvesting process which causes atmospheric pollution and respiratory diseases in the local population. Burning of rice straw has become a regular phenomenon in Malaysia and gave a negative effect to environment and also main factor for health problem such as asthma. This environmental problem has been reported by Arai et al. (1998) and Torigoe et al. (2000) in Japan. Therefore, eliminating such residues is not only a problem in our country, but in all those areas in the world where this grain is grown. The study on the effect of EM on the composting process of rice straw will help our farmers to manage their organic waste through beneficial ways thus will help to increase the rate of composting, improve their yield and also reduce environmental problem.

iii. Research Objective

- To evaluate the composting process of rice straw with or without EM addition
- To determine the nutritional status of the resultant compost
- To assess the effect of EM compost application on *Oryza sativa* growth and yield.

iv. Literature Review

Enhanced decomposition of plant material after addition of EM during Bokashi production has been proposed as an innovative approach that allows the odorless breakdown of banana residues in as little as 3 weeks and the facilitation of a rapid recycling of plant nutrients (Shintani and Tabora, 2000).

The action of EM does not occur in isolation. The microorganisms in EM also need food, thus the effectiveness of EM is best obtained with organic matter. The microbes have the ability to breakdown the organic matter thus releasing beneficial soluble substance such as amino acids, sugars, alcohol, hormones and

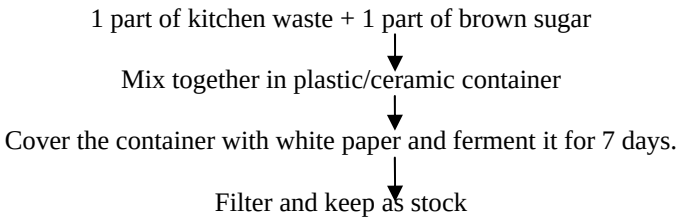
similar organic compounds. These are absorbed by plants, and thus the growth is enhanced (Higa, 1999).

The use of microorganisms to initiate the composting process and possibly reduce the composting time is not an uncommon practice. For example, the use of cellulose-decomposing fungal (*Trichorderma harzianum*) has been reported to reduce composting time from 12 to 4 weeks (Mishra *et al*. 2003).

v. Research Methodology

a. Preparation of Effective Microorganism

The preparation of EM using kitchen waste will be apply to the rice straw for composting process. The organic kitchen waste such as vegetable, rice, meat and etc. will be recycle back as EM stock. The process of EM production is:



b. Preparation of compost

2L of EM-stock solution will be diluted in a closed plastic barrel with 2 L of molasses and 60 L of tap water (1:1:30). After 7 days, this mixture will apply to compost piles for twice a week (treatment EM). For control treatment the compost will be apply using water (W). The preparation of compost using heap method with 1:1:1 ratio that is 1 part of rice straw, goat manure and green waste. The composting process of rice straw using EM, and W will be conducted until the compost material became earth like such as humus and smell like earth with brown dark color.

c. Pot experiment

Paddy plants will be planted in 22 L plastic pots filled with a mixture of 16 L of a typical rice field planting soil and 6 L of compost (EM= produced with activated EM; W = produced with water). Each treatment, replicated five times, comprised one plant per pot. The plants placed in a randomize block design in the greenhouse and rearranged every 4 day within blocks. After mature total plant were harvested and yield count.

d. Chemical analyses of the compost samples

- **Potassium (K), Phosphorus (P)**
  Using Inductively Coupled Plasma Mass Spectrometry (ICP-MS)
- **Total Organic carbon**
  5g of samples weighted into tarred crucible and then heated in a muffle furnace at 550-600^{o}C for 6 hour, cooled in a desiccators and re-weight. The loss in weight represents the organic matter. The approximate organic matter value with 1.72.
  Organic carbon % = $\frac{\text{organic matter in\%}}{1.72}$

- **Total Nitrogen**

Total Nitrogen will be determine using Kjeldahl method