# A scientific evaluation of the Takakura Composting Method (TCM)

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A pilot-scale Takakura composting system, analogous to a system that has already been implemented at the community level in developing countries was constructed. Various controlled scientific experiments were carried out with a view to evaluating its performance. Previous scientific research on Takakura composting has been very limited and its advantages over more conventional composting methods have not been clearly delineated.

Thus, two different types of fermentation solution (salt-based and sugar-based) were prepared utilizing locally available vegetable/fruit waste and fermented products. Physico-chemical parameters such as temperature, pH, conductivity, total organic carbon, nitrogen and the concentration of volatile fatty acids, lactic acid and ethanol were monitored with a view to optimizing the fermentation solution (FS) with respect to time and substrate quantity, Figure 1.

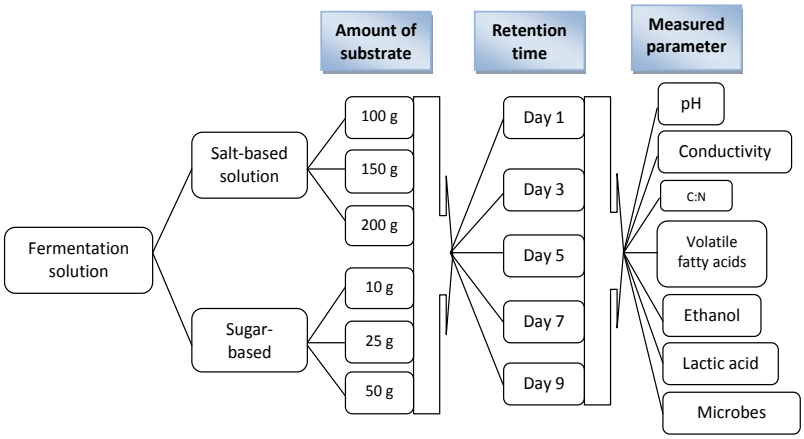


Figure 1: Schematic diagram of the experimental plan for fermentation solution optimization

Subsequent to this, three different compositions of seeding inoculate (SI) were prepared utilizing the native microorganisms isolated in the FS, Table 1.

Table 1: Relative proportions of fermenting bed materials for the seeding inoculate variants. RH – Rice husk; RB – Rice bran; WB – Wheat bran; FS – Optimal fermentation solution (i.e. 150 g of substrate in salt sol + 25 g of substrate in sugar solution).

| Seeding inoculate | Fermenting bed combination | Proportion (by weight) | Mixed fermentation solution | Compost |
|---|---|---|---|---|
| Basket A (SI-A) | RH:RB | 1:2 | 2 L optimal FS + 2 L water | Compost A (CA) |
| Basket B (SI-B) | RH:RB | 1:1 | 2 L optimal FS + 2 L water | Compost B (CB) |
| Basket C (SI-C) | RH:WB | 1:1 | 2 L optimal FS + 2 L water | Compost C (CC) |

Three different TCM matrices (of compost) were then prepared utilizing the three different compositions of SI and the compost quality was assessed by monitoring parameters such as temperature profile, pH, conductivity, carbon-to-nitrogen ratio, available nutrients (nitrogen, phosphorus and potassium), micronutrients and trace metals -

over 35 days. The compost maturity was also tested by four different methods - germination percentage, plant bioassay, C:N ratio and Fourier Transform Infrared (FTIR) spectroscopy. Several novel methods were introduced for analyzing the relative growth characteristics of the test plants, Figure 2, including a new index, termed the 'Bushiness Index' (BI) that was introduced to assess the health of test plants in terms of the number of leaves and height of the plant, Figure 3.

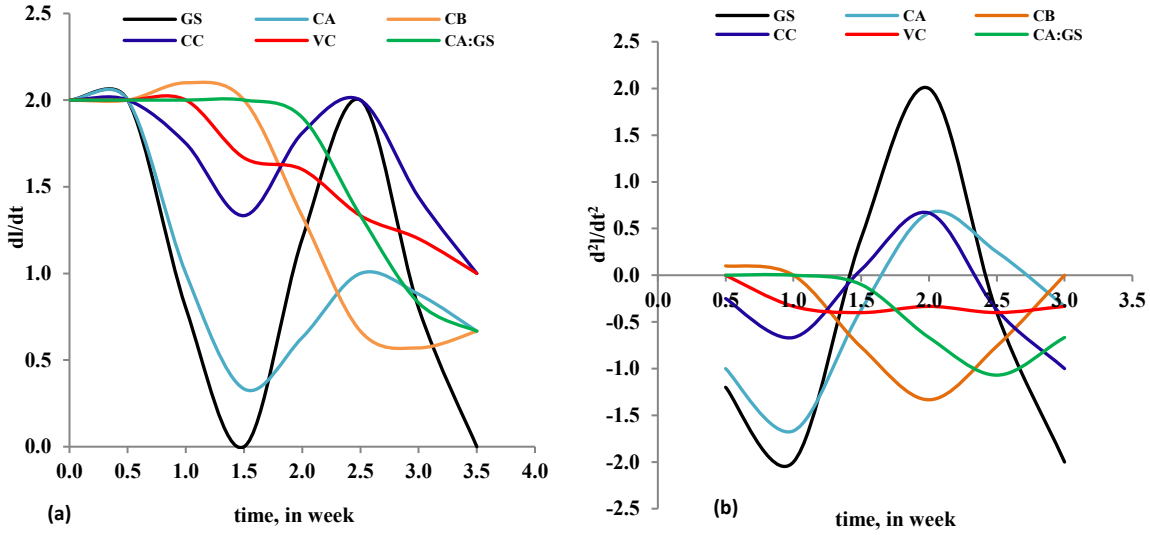


Figure 2: (a) Differential plot and (b) Double differential plot of the average number of leaves over time.

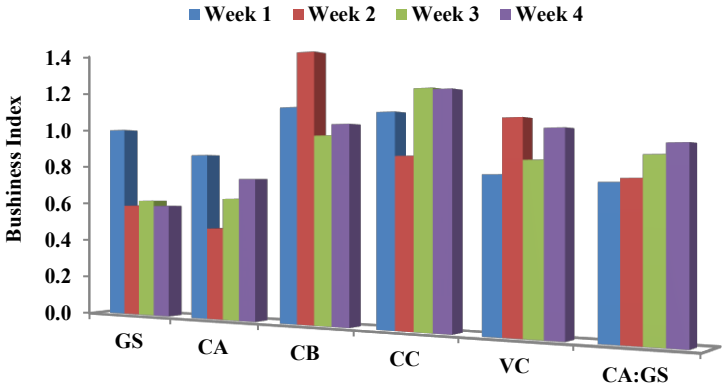


Figure 3: Relative Bushiness Indices as a function of time for GS (Garden Soil), CA (Compost A), CB (Compost B), CC (Compost C), VC (Vermicompost) and CA: GS (Mixture).

These studies revealed that the ideal FS could be obtained with a desired quality by varying the time and substrate quantity. With respect to the quality of TCM matrices, the matrix with very high nutrient levels were found to be unfavorable for seed germination and seedling growth, which suggests that a too high a nutrient level in the compost could exhibit phytotoxic characteristics. However, when the same matrix was mixed with garden soil (GS), it was found that it imparts nutrients to the GS, which produced relatively healthier plants. The findings of this study showed that TCM is "tunable" via the manipulation of the seeding inoculate.

References:

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