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The Potential of Using Cost-Effective Compost Mixtures for Oyster Mushroom (*Pleurotus* spp*)* Cultivation in Sri Lanka

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ABSTRACT

Edible mushroom cultivation is a profitable cottage industry, in which oyster mushroom occupies a prominent place in Sri Lanka. A good substrate is a key factor that determines the profitability of the mushroom cultivation. The Department of Agriculture recommends soya flour as a nitrogen supplement for mushroom substrate. Nonetheless production cost could be minimized if cheaper nitrogen sources could replace the traditional ingredients. Therefore the relative efficacy of six compost mixtures, each amended with one of the following nitrogen sources (viz-gliricidia leaf powder, poultry litter and urea) were compared with the standard soya flour amended compost mixture to study their suitability as potential substitute/s. The addition of gliricidia leaf powder and urea were determined by the percentage nitrogen (%N) of each compound. Percentage N of well-decomposed poultry litter was calculated by using kjeldhal method (Available N =%N*6.25). The experiment was laid in Complete Randomized Design with seven treatments and fourteen replicates. The mycelia growth rate after spawning, mushroom yield, and the duration for the first frutification were used as indicators. The results revealed that the most suitable compost mixtures for higher mushroom yields were those containing 6.6% poultry litter.

Keywords: oyster mushroom, culture substrate, mycelial growth and frutification

INTRODUCTION

Mushrooms belong to class Basidiomycetes are fleshly saprophyte fungi which are found growing on damp rotten wood trunk of trees, decaying organic matter and damp soil rich in organic substances. *Pleurotus ostreatus* (Jacq.) Kumm. is a commercially important edible mushroom highly acclaimed for its gastronomical, nutritional and therapeutic properties (Ibekwe *et al.,* 2008, Belewu and Belewu 2005, Yildiz and Yesil 2006).Unlike other mushrooms *Pleurotus* species has the unique adaptation to a wide range of lignocellulosic substrates (Bermudez *et al*., 2001) and the cultivation of this mushroom has increased tremendously throughout the world during the last few decades ranking it as the second most important edible mushroom variety in the world mushroom market (Larraya *et al*., 2000). However in Sri Lanka it is the predominately cultivated species (Gnaneswaran and Wijegunsekera, 1999). For a successful mushroom cultivation three factors *viz*-reliable spawns, good substrate and conducive environment have to be satisfied. Moreover substrate preparation is known as the" heart of the process" thus a substrate that can provide adequate nutrients for the mycelial growth and fruitification plays a key role in determining the success of the cultivation. Our efforts were focused to minimize the production costs and to improve the production efficiency. In Sri Lanka sawdust is used as the main ingredient amended with rice bran and a protein supplement as the growth substrate for the cultivation of oyster mushrooms and Soya and green gram powder are the frequently included protein supplementations in substrate preparation. However the cost of production can be minimized with the substitution of cheaper nitrogen sources such as animal manure which can supply a substantial amount of major plant nutrients (Maraikar and Amarasiri, 1988), secondary nutrients

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(Wijewardena, 1993). The objective of this study was to evaluate the relative efficacy of seven substrates
(composting mixtures) on the growth and yield of oyster mushrooms.

MATERIALS AND METHODS

Preparation of the substrate

The composition of the mushroom substrate was determined according to the Department of Agriculture (DOA) recommendations. Saw dust (40Kg), soft rice bran(4Kg), Calcium Carbonate (800g), and Magnesium Sulphate (80g) was mixed with water until suitable moisture content was obtained. Also soya flour similar to the DOA recommendation was added to the control in comparison with three testing amendments (poultry manure (PM), Gliricidia leaf manure (GM), and urea) which were added separately at two different concentrations to test the relative efficacy of each substrate.

Six mushroom growth substrates enriched with one of the following N sources (PM, GM, and urea) at a given concentration were compared with the control. Considering the available N present in the given dose of the Soya flour, the amount of enrichment added was calculated either to commensurate the same or double that value.

Accordingly the following amounts were used.

GM-97.74g and 195.48g (1.6% & 3.2% wt)
PM-197.47g and 394.94g (3.3% & 6.6% wt)
Urea 51.55g and 103.1g (0.9% & 1.8% wt)
Soy flour 30g (3.0% wt)

The following treatments were used

control substrate enriched with soyflour
GM1 1.6% of Gliricidia leaves by wt
GM2 3.2% of Gliricidia leaves by wt
PM1 3.3% of Poultry manure by wt
PM2 6.6% of Poultry manure by wt
U1 0.9% of Urea by wt
U2 1.8% of Urea by wt

The %CP values for the amendments Urea and GM were extracted from published data (Anon, 1978; and Weerakoon and Liyanage, 1978. Percentage N in well-decomposed PM was calculated by using kjeldhal method (% CP=% Nx6.25).

The compost preparation was filled into 32.5 cm x 17.5 cm polypropylene bags and was subjected to steam sterilization for 2-3 hours.

Mushroom spawn inoculation and incubation

Once sterilized and cooled, grain spawns of American oyster were introduced (inoculated) into the compost media. The inoculated compost bags were kept in the darkness until the mycelia has completely penetrated to the bottom of the substrate.

The experiment was laid in Complete Randomized Design having seven treatments and fourteen replicates.

At the end of the incubation period upper portion of the spawned mushroom bags were cut open to facilitate the mushroom frutification. Frequent but light irrigation was provided to maintain a conducive humid atmosphere for the mushroom development.

Method of analysis

Weekly mycelial growth rate after the inoculation and the fruiting body yield during the cropping period were measured. The mycelial growth was measured in cm as the length of the mycelium spreading from the mouth of the bag towards the bottom side. These measurements were taken from five different points marked with similar distances along the circumference of the compost bag upon which the mean value was calculated.

Data was analyzed using (Statistical Analysis of Software) SAS package.

RESULTS AND DISCUSSION

The effect of seven different growth substrates on the mycelial and fruit body yields are shown in Figure 1.

More vigorous and fastest mycelial growth was observed on substrates amended with PM while two treatments amended with different urea additions showed no visible mycelial growth. There was no significant difference in mycelial growth between the GM treatment at 1.6%and the control. However slow mycelial growth was indicated in GM treatment at 3.3%.Growth of the mushroom in different

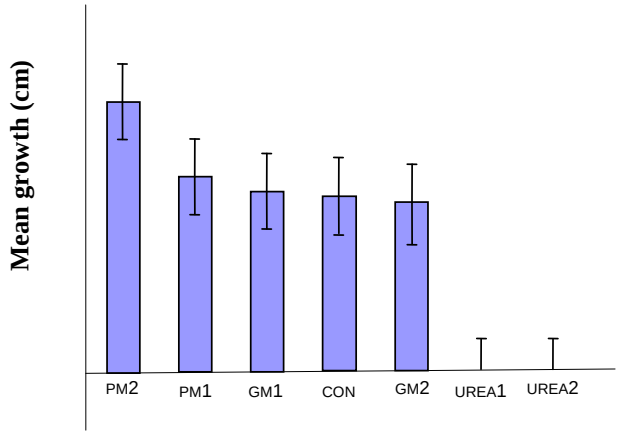

Figure 1: Mean mycelia growth in different treatments in the first week

pm = poultry manure, gm = gliricedia leaf manure, u = urea, con = control

substrates showed that substrate amended with 6.6%PM gave the maximum yield (Figure 2) and followed by the substrate containing 1.6% GM.

In addition to high yields, the least duration for frutification was also observed in PM treatment @ 6.6% level (Table1).

This study suggests that the mushroom growth substrate has a great impact on the pattern of mushroom mycelial growth and subsequent frutification. This agrees with the previous work of Chang and Miles (1989) that mushroom production was influenced by the composition and the pH of the substrate, light availability, temperature and the degree of aeration. An added advantage of using PM as a mushroom substrate amendment is the availability of high amount of Calcium (Wijewardena, 1998), Copper, Manganese and Iron in addition to the major nutrients (Bandara *et al*., 2006). It has been reported by Chiu *et al*., (1997) that compost supplementation with Calcium is desirable for cultivation of oyster

Table 1: Number of days taken to appear fruiting bodies in each treatment

Treatment	Mean (Days)
GM2	9.3[a]
GM1	8.8[a]
PM1	7.9[ab]
Control	6.0[b]
PM2	4.2[c]

Mean followed by the same letter(s) are not significantly different at 5%

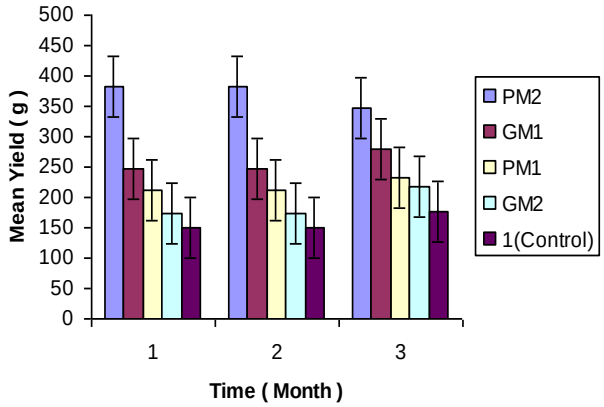

Figure 2: Mushroom yields in different treatments

pm = poultry manure, gm = gliricedia leaf manure, u = urea, con = control

mushrooms. Moreover the beneficial effects of manganese (Curvetto *et al*., 2002), and Iron (Yildiz and Yesil, 2006) for oyster mushroom cultivation is well-documented.

Contrary to the report by Quimio *et al.* (1995) that urea supplement dissolved in water would enhance the mushroom yield, urea treated substrates in our study completely failed to show any mycelial growth. However Chang and Miles (1993) reported the poor utilization of urea as a nitrogen source to oyster mushrooms.

CONCLUSION

In terms of the mushroom yield and the cost effectiveness of the material, substrate amended with poultry manure @6.6% can be considered as a better substitute to the standard Soya flour based substrate for oyster mushroom cultivation.

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