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IDENTIFICATION OF LOW-COST GROWTH MEDIUM FOR SPAWN PRODUCTION OF OYSTER MUSHROOM (*Pleurotus* spp)

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ABSTRACT

The paddy seeds (*Oryza sativa*), which is the commonly used substrate to produce spawn in mushroom cultivation in Sri Lanka, have some disadvantages such as high cost and microbial contamination. Saw dust is being used in many countries as the base material for spawn production. Hence, this study was carried out to find the most suitable saw dust for mushroom spawn production. Four locally available sources of saw dust namely, rubber (*Hevea brasiliensis*), mango (*Mangifera indica*), lunumidella (*Melia dubia*) and jack (*Artocarpus heterophyllus*) were used in this experiment with paddy seeds. A higher growth rate of mycelium was observed in the paddy seed medium. However, contamination from other organisms was higher in paddy seed medium compared to the saw dust media tested. The mean number of fruits and yield of mushroom were statistically not different when using spawn produced in paddy seeds and saw dust media of mango and rubber were used. Due to low cost and lower contamination mango and rubber saw dusts are more suitable as base medium for spawn production of oyster mushroom.

KEYWORDS: Oyster mushroom, saw dust spawn, rubber and mango saw dust

INTRODUCTION

The cultivation of *Pleurotus* species of mushroom (oyster mushroom) in Sri Lanka has gained a considerable popularity in recent years. At present, the popularity of mushroom is due not only to their culinary value but also to their potential as a source of protein that can enrich human diets, especially in some developing countries, where animal source of foods may be rare and expensive. It is now established that, apart from their high nutritional attributes, some have therapeutic as well (Bahl, 2002).

As in any agricultural crop, mushroom cultivation also needs good seed material known as "spawn". A suitable material should be used to prepare the medium to grow mushroom mycelium (Chang, 1999). Presently, paddy seeds are the most common raw material used to produce mushroom spawn in Sri Lanka. However, there are some disadvantages in this method such as high cost of production and high microbial contamination. Therefore, the introduction of an alternative medium for mushroom seed production will be useful for the mushroom farmers in Sri Lanka.

Some countries such as Japan, Korea and China use saw dust to produce mushroom spawn instead of paddy seeds. Saw dust of soft wood trees has been recommended for mushroom spawn production due to easy penetration of the mycelium (Chang, 1982). Saw dust of soft wood trees is also freely available in Sri Lanka. Therefore, this experiment was conducted to find the possibility of using available saw dust materials in Sri Lanka and to select the most suitable type of saw dust for mushroom spawn production

MATERIALS AND METHODS

This study was carried out from July to December, 2010 at the Regional Agricultural Research and Development Centre (RARDC) located at Makandura, Gonawila (NWP), Sri Lanka. The experimental site was situated in the low country intermediate zone (IL_1) and the climate of the region is characterized by the mean monthly temperature of 30.8°C and annual mean rain fall of 2000 mm.

Paddy seed (*Oryza sativa*) var. Samba (control) (T_1), saw dust obtained from four different tree species rubber (*Hevea brasiliensis*) (T_2), mango (*Mangifera indica*) (T_3), lunumidella (*Melia dubia*) (T_4) and Jack (*Artocarpus heterophyllus*) (T_5) were used as the materials for different treatments. In addition, gypsum (4 %), calcium carbonate (2 %) and glucose (0.5 %) were used as supplementary materials for all the treatments. Potato dextrose agar (PDA) medium was used to culture the mycelium of oyster mushroom. Polypropylene bags (17.8 cm width, 30.5 cm height and 200 gauge), rubber bands, cotton wool and plastic neck (ring) were used to prepare the spawn bags and compost (growing) bags.

Spawn preparation using different substrate.

Growth of, and transferring of mycelia were done under aseptic conditions. For mother culture preparation, mushroom mycelia were grown on PDA plates using tissues obtained from the neck area of clean mushrooms, which have typical shape and colour. The mycelia grown on PDA were transferred to the spawn media to obtain mother spawn. Thereafter, a small portion of mother spawn (one tea spoon) was transferred to the commercial spawn medium.

Preparation of seed substrates

Paddy seeds were washed thoroughly and soaked in water for one h. Seeds, which floated on water were removed. Then the seeds were parboiled for about one h until they become soft, and the excess water was drained. Finally the paddy seeds, and saw dust from rubber, mango, lunumidella and jack were separately mixed with adequate amount of water and gypsum, $CaCO_3$ and glucose according to the dry weight of saw dust at the proportion stated previously. Two hundred grams of mixture was then loosely packed in polypropylene bags and plugged with non-absorbent cotton. Both paddy seed and saw dust bags were sterilized in an autoclave at 15 kg/cm^2 pressure and 121°C for 25 min. The bags were inoculated with mycelia obtained from PDA plates kept under the aseptic conditions. The inoculated bags were incubated at 25±1°C. Twenty mother spawn bags of different media were included for each treatment in a randomized complete block design (RCBD) with four replicates.

Preparation of commercial spawn

The paddy seed and saw dust media were prepared as stated above. Fully colonized mother spawn was used to inoculate commercial spawn bags. Twenty commercial spawn bags of different media were as for mother spawn bags in RCBD with four replicates.

Cultivation of mushroom using different spawn

One hundred kg of saw dust (rubber), 10 kg of rice bran, 2.5 kg of dolomite, 250 g of $MgSO_4$, 1 kg of gypsum and adequate amount of water were mixed. Compost bags (250) were prepared using polypropylene bags (200 gauges, 33 cm long and 17.7 cm wide), which were steam sterilized using a barrel. The bags were inoculated on the following day with spawn (50 bags were inoculated with each treatment). Then the bags were arranged in RCBD (10 bags per treatments per replicate) with 5 replicates. The inoculated bags were incubated for 25-30 days. The bags were opened after the incubation period and harvesting was done after maturation of fruits (8-10 days after opening for harvest).

The number of contaminated bags, days required for full growth of mycelium in the medium and benefit:cost ratio were measured in both spawn and mushroom growing medium. The number of fruits and fruit weight were for each treatment. Additionally, the ratio of benefit:cost was calculated for different treatments.

RESULTS AND DISCUSSION

Evaluation of growth rate of mycelium of commercial and mother spawn

Mother spawn production in paddy seed showed the fastest rate of mycelium growth while jack saw dust showed a slowest rate. There were significant differences in the days taken for completion of spawn run between paddy spawn and all other treatments. Also there was a significant different of growth rate of mycelium in rubber and mango saw dust compared to other saw dusts (Table 1).

Paddy seed spawn showed a fastest rate of mycelium growth during the spawn run of commercial spawn. The slower rates of mycelium growth of commercial spawn were shown in jack and lunumidella saw dust compared with all other treatments. However, there were significant difference in the days taken in rubber and mango saw dust compared to other saw dusts.

Table 1. Growth of mushroom mycelia on different base materials of mother spawn and commercial spawn.

Treatmen	*Days taken to complete the mycelial growth*	
	Mother spawn	*Commercial spawn*
T_1 (paddy)	13.50 [d]	12.2 [c]
T_2 (rubber)	17.20 [c]	15.9 [b]
T_3 (mango)	16.70 [c]	15.8 [b]
T_4 (lunumidella)	18.90 [b]	17.6 [a]
T_5 (jack)	20.40 [a]	17.5 [a]

Within a column means followed by the same letter are not significantly different at p = 0.05 according to the DMRT.

Evaluation of contamination in commercial and mother spawn

The paddy seed spawn showed the highest rate of contamination both in mother spawn and commercial spawn compared to other treatments. There were significant differences ($p<0.05$) in contamination of mother spawn and commercial spawn in paddy seed compared to the all saw dust media. Further, all saw dust media showed very low contamination rate (Table 2).

Table 2. The number of un-contaminated spawns produced using different base materials

Treatmen	*Mean number of uncontaminated spawn*	
	Mother spawn	*Commercial spawn*
T_1 (paddy)	16.0[b]	16.0 [b]
T_2 (rubber)	19.5[a]	19.3 [a]
T_3 (mango)	19.0[a]	19.0 [a]
T_4 (lunumidella)	19.0[a]	18.6 [a]
T_5 (jack)	18.0[ba]	19.3 [a]

Within a column means followed by the same letter are not significantly different at p = 0.05 according to the DMRT.

Number of fruits and fruit weight

The highest spawn fresh weight (yield) of 302 g obtained with mango spawn (T-3) followed by paddy (T-1), rubber (T-2), lunumidella (T-4) and jack (T-5), of 295 g, 292 g, 246 g and 230 g, respectively. However, there was no significant difference of yield among any of treatments (Table 3). Although, there was a significant difference ($p<0.05$) in fruit weight among treatments, there was no significant difference ($p>0.05$) in the number of fruits. This is mainly due to the difference in the size of the fruits.

Table 3. Yield and number of fruits of mushroom on compost bags when bags inoculated with different inoculums grown on various base materials

Treatment	*Mean yield(g*	*Mean number of fruits*
T_1 (paddy)	295[a]	46.5 [a]
T_2 (rubber)	292[a]	53.5 [a]
T_3 (mango)	302[a]	52.0 [a]
T_4 (lunumidella)	246 [b]	51.0 [a]
T_5 (jack)	230[c]	49.0 [a]

Within a column means followed by the same letter are not significantly different at p = 0.05 according to the DMRT.

Benefit: cost of different treatments of spawn production

The ratio of benefit:cost is higher in all saw dust treatments compared to paddy seed spawn. This is mainly due to the low materials cost of saw dust treatments (Table 4). However, when the contamination and yield considered, rubber and mango saw dust appeared as better performers compared to jack and lunumidella saw dust.

Table 4. Benefit: cost of different treatments of spawn production

Treatments	*Material cost for mother spawn production (Rs.)*	*Material cost for commercial spawn Production (Rs.)*	*Labor Cost (Rs.)**	*Total Cost (Rs.)*	*Income (Rs.) ***	*Benefit; Cost*
T_1	183.20	183.20	50.00	416.40	1320.00	3.17
T_2	103.20	103.20	50.00	256.40	1544.00	6.03
T_3	103.20	103.20	50.00	256.40	1520.0	5.92
T_4	103.20	103.20	50.00	256.40	1488.00	5.80
T_5	103.20	103.20	50.00	256.40	1544.00	6.03

*Labor unit = Rs. 500.00, **Price of 1 packet of paddy and saw dust seed (200g) = Rs. 80.00

CONCLUSIONS

High benefit:cost ratio of spawn production of oyster mushroom was observed in all spawn produced from the saw dust media compared to the paddy seed spawn. However, when compared to spawns produced from different saw dust based media, a higher rate of mycelium growth, a lower contamination and a high yield appeared in rubber saw dust, and mango saw dust spawn. Therefore, rubber saw dust and mango saw dust can be used as alternatives to paddy seed for the production of spawn of oyster mushroom in Sri Lanka.

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