VARIATION IN OYSTER MUSHROOM PRODUCTION ON COCONUT BY-PRODUCTS AS INFLUENCED BY MIXING OF SUBSTRATES

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ABSTRACT

Although paddy straw is considered to be the best substrate for oyster mushrooms, it has become necessary to find out locally available and cheaper agro-wastes as alternate substrates due to the increasing cost and non-availability of paddy straw in several areas. Large quantities of by-products, which are high lignocellulosic in nature are available in coconut plantations and homestead gardens throughout the year at little or no cost. Oyster mushroom cultivation trials were conducted with coconut by-products individually and in different combinations in a low cost mushroom house constructed in a coconut garden. Variation in respect of total yield of mushrooms, biological efficiency of conversion and crop duration were observed in different coconut by-products and their combinations. Leaf stalk, bunch waste, and spathe were better substrates than bunch stalk, leaflets and coir pith when tested individually. However, mixing of coir pith and leaflets with certain other substrates resulted in higher yield of mushrooms. Coir pith + leaf stalk and bunch waste + leaflets (1 : 1 ratio) yielded more mushrooms than other combinations tested. Crop duration of *Pleurotus sajor-caju* (Fr.) Singer (Oyster mushroom) major was more in coconut by- products, particularly when leaf stalk was the substrate.

INTRODUCTION

Mushrooms collected from natural habitats have been consumed as an edible food item for centuries due to their flavour and taste. Artificial cultivation technology is now available for several species of mushrooms in different parts of the world. The commercially cultivated mushrooms in the country are the white button mushroom *(Agricas bisporus)*, Paddy straw mushroom *(Volvariella volvacea)* and oyster mushroom *(Pleurotus* spp.*)* Among these, the cultivation of oyster mushroom is advantageous in several regions of the country due to suitable climatic conditions, simple low-cost technology and availability of large quantity of agricultural wastes for use as substrates.

Paddy straw is the most widely used substrate for cultivation of oyster mushroom (Suharban and Nair, 1994). The increasing cost of paddy straw and its non-availability are factors limiting the spread of mushroom technology particularly in plantation sector. The coconut palm *(Cocos nucifera L.)* is being cultivated in almost every household in Kerala and hence plenty of by-products which are lignocellulosic in nature are available at little or no cost. Thomas *et al.* (1997) reported the feasibility of utilizing lignocellulosic biomass from coconut palm as alternate substrate for cultivating oyster mushrooms. The present study was undertaken to evaluate oyster mushroom production on coconut by-products when tested individually and in different combinations.

MATERIALS AND METHODS

The by-products of coconut palm such as spathe, bunch stalk, bunch waste, leaf stalk, leafets and coir pith were evaluated individually. Combinations of by-products viz. Coir pith + leafstalk, in 1 : 1 (W/W) ratio were also tested as substrates for oyster mushroom cultivation.

Pure culture of *Pleurotus sajor-caju* (Fr.) Singer maintained on potato dextrose agar was used for preparing spawn. Sorghum grains were boiled and mixed with 3% $CaCO_3$, filled in empty glucose bottles, sterilized at 1.05 kg. cm^2 pressure for two hours and inoculated with *P. sajor- caju* cultures.

Freshly harvested by-products of coconut palm were collected from the field, chopped to 5-8cm bits and sun-dried. The substrates were soaked overnight in clean water and then sterilized in an autoclave at 1.05 kg cm^2 pressure for one and a half hours. Beds of three kg fresh weight of substrates were prepared with 60 x 45 high density polythene bags by multilayered technique using sterilized substrates, 5% rice bran as organic supplement and 3 % spawn. Five replications were maintained for each treatment.

Beds were kept for spawn run for a period of about 20 days in a low-cost mushroom shed built with coconut materials inside a coconut garden. After complete spawn run, beds were removed and kept for cropping by watering twice daily after two days of opening of beds. Mushrooms were harvested in different flushes and the yield of fresh sporophores at each flush was recorded. The beds were sprayed with a solution of 1% urea and 1% super phosphate when there was delay in frutification. Biological Efficiency (BE) was calculated as the percentage yield of fresh mushrooms in relation to dry weight of the substrate (Chang and Quimio, 1982).

RESULTS AND DISCUSSION

The data on mushroom production and cropping pattern of *P. sajor-caju* using different by-products of coconut palm as substrate, are presented in Table 1. The quantity of fresh sporophores harvested from different by-products varied significantly. The cumulative yield of mushroom from the different flushes was higher in leaf (531g stalk bed), spathe (435.8g) and bunch waste (443. 6 g). The other substrates such as leaf lets, bunch stalk and coir pith yielded only lesser quantities of mushrooms.

Table 1. Mushroom production on coconut by-product Substrates

Substrate	Mushroom Yield (g /bed)	Biol. Efficacy (%)	Days for primordia formation	Cropping period (Days)
Leafstalk	531.0	53.0	21.0	72.6
Spathe	453.8	47.0	22.4	44.0
Bunch waste	443.6	48.3	21.4	59.3
Leaflets	371.3	34.1	22.8	38.3
Bunch stalk	298.2	32.8	25.0	47.2
Coir pith	105.6	23.5	16.2	38.0
LSD (P = 0.05)	145.8	13.3	2.7	NS

Biological Efficiency (BE) of conversion also varied significantly in different by-products of coconut. Higher BE of 53% was recorded in leaf stalk followed by 48. 3% in bunch waste, and 47% in spathe. Days for primordia formation varied from 16.2 to 25 days in different by-products, but most of the substrates showed primordia initiation within 22 days. Cropping period was extended when leaf stalk was substrate (72.6 days) followed by bunch waste (59.3 days) and in bunch stalk. Other substrates required only 38 to (44 47.2 days) for mushroom production.

Mushroom yield varied significantly in different combinations of coconut by-products (Table 2). Higher mushroom yield was recorded in 1 : 1 combinations of bunch waste + leaflets (556.7 g/ bed) leaf stalk + leaflets (431.7), and coir pith + leaf stalk (35. 6g). BE was more in coir pith + leaft stalk (60. 3%) and bunch waste + leaf lets (52 %), combinations. Although days

.Table 2. Mushroom production in mixtures of coconut by-products

Substrate Mixture	Mushroom Yield (g/ bed)	Biol Efficacy (%)	Days for primordia formation	Cropping period (Days)
Coir pith + Leafstalk	356.0	60.3	18.6	75.0
Coir pith + Leaflets	245.8	39.3	23.2	34.0
Coir pith + Bunch waste	326.6	43.0	19.0	53.4
Bunch waste + leaflets	556.7	52.0	25.0	51.4
Leaf stalk + leaflets	431.7	38.9	24.0	63.8
LDS (P = 0.05)	140.7	Ns	0.7	20.4

for primordia initiation, varied in different combinations, it was in the range of 18.6 to 25 days. Coir pith + leaf stalk combination required a longer cropping period of 25 days, while the mushroom yield was obtained at a shorter period of 51.4 days in bunch waste+leaf lets combination

The chemical composition of substrate and the environmental conditions under which mushrooms are cultivated will determine the yield of mushroom crop (Manu - Tawiah and Mmartin, 1986). The variation in mushroom yield in different by - products in the present study could be attributed to the chemical composition of the substrates. The cellulose content and cellulose : lignin ratio were positively correlated with the mushroom yield (Thomas *et al.* 1997). Utilization of lignocellulosic wastes is dependent on the ability of the enzyme to secrete a range of enzymes including cellulase, xylanase and liguninases (Kumaran *et al.* 1997). Leaf stalk, spathe and bunch waste were better substrates with BE of 53, 48.3 and 47.0% respectively. Kochu Babu and Nair (1991) reported 58.4 and 55.7% conversion by *P. florida and P. sajor-caju,* respectively, on mesocarp waste of oil palm. Though leaf stalk showed superiority in yield of mushroom, the cropping period was longer (72.6 days).

Different combinations of by-products were also suitable as substrates yielding mushrooms in varying quantities. Bunch waste + leaf lets and coir pith + leaf stalk combinations were superior with respect to total mushroom yield and BE. The cropping period was extended when leafstalk was one of the substrates. Mathew *et al.* (1996) reported that cropping period of different species of *Pleurotus* varied in different substrates. They reported a cropping period of 60-65 days for *P. sajor-caju* when rubber wood saw dust was substrate compared to 40-45 days in paddy straw. Coir pith, which is available in higher quantities as a by-product from coir industry, was a poor substrate when tested individually. There was significant improvement in mushroom yield when coir pith was mixed with other by-products of coconut. Similar observations were also reported by Eyni *et al.* (1995) while studying the performance of *Pleurotus ostreatus* in coir pith and paddy strow individually and in combination. They reported higher yield of mushroom and BE in 1 : 1 combination of coir waste and paddy strow when compared to the use of coir pith. Some of the by-products of coconut palm such as bunch waste are better substrates for mushroom production, but are available in lesser quantities. On the other hand, by-products like leaf lets are available in higher quantities, but they are not as efficient for mushroom production. The present study has demonstrated the feasibility of mixing these by-products effectively to obtain higher mushroom yield.

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