INFLUENCE OF DIFFERENT SUBSTRATES ON THE GROWTH AND YIELD OF OYSTER MUSHROOM

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Abstract: The present investigation was carried out in Department of Microbiology at Government PG College, Ratlam, M.P (India). The farming of white rot edible fungus cultivation of Pleurotus sajor-caju was carried out on paddy straw, wheat straw and sugarcane bagasse using cylindrical block system to find out suitable substrate. The substrates significantly influenced on mycelial growth, spawn running, pin head formation, maturity of fruiting bodies, number of flushes and amount of yield. The highest number of primordia and fruiting bodies, and the amount of fresh weight was obtained with sugarcane bagasse in all flushes whereas, the lowest with wheat straw.

Keywords: Oyster mushroom, Pleurotus sajor-caju, Substrates, Yield.

Introduction: Oyster mushrooms are packed with most strong natural medicines for HIV and antioxidants (https://www.awesomechef.in). More than 100 varieties of species of mushrooms are being investigated for their health promoting benefits (Craig, W.J., 1999). of those hundred, about a half dozen really stand out for their ability to deliver a tremendous boost to your immune system (Borchers, A.T2004). Very recently, Barros, A.B., et al (2016) found a wide variety of health benefits of mushrooms like weight management, increasing vitamin D levels through your diet, improved nutrition, improved immune system function.

Pleurotus is renowned as an excellent mushroom. It can be cultured within a wide range of temperatures on different natural resources and agricultural wastes. Consequently, the cultivation of P. sajor-caju has increased extremely all over the world (Go, S.J et al, 1985, Pokhrel, C.P et al, 2013, Tupatkar, P.N. and Jadhao, S.M., 2006, Jhadav et al, 2014). Singh (1981) found that *P. sajor-caju* could be grown successfully on paddy straw at a temperature range of 19.1-30.50 C with 65-85% relative humidity. Whereas, Sivaprakasam and Kandaswamy (1981) reported a wide variety of substrates like waste papers, sugarcane bagasse, hulled maize cobs and rice straw for the production of its sporophores. In the present investigation, a white-rot fungal species *P. sajor-caju* were assessed for growth and yield on paddy straw, wheat straw and sugarcane bagasse.

Substrate; Choosing a correct substrate for mushroom cultivation is an important decision. A substrate is just any substance on which mycelium will grow. Carbon, nitrogen and inorganic compounds are required for proper growth of mushroom and cellulose, hemicelluloses and lignin form best source of carbon.

Large quantities of agriculture remains like rice, wheat and sugar cane are produced in India. Agriculture remains serve as important source of lignocellulosic materials, which is best substrate for solid state fermentation of edible fungi such as *P. sajor-caju*.

At present, agriculture residues are disposed off through open-field burning, which causes a serious environment pollution problem. If such agricultural straw can support the growth of oyster mushroom, then it would be one of the solutions to convert these unpalatable wastes into a usual edible biomass of high market value, and serve as a cheap source of substrate for mushroom grower (Yang, W et al, 2013).

Paddy straw: The chemical composition of paddy straw varies between varieties and growing seasons, with higher nitrogen and cellulose contents in early-season rice compared to others. It contains 41% cellulose, 36% lignin, 0.45% total N. Wheat straw contains 1% protein, 13% lignin, 39% hemicelluloses, 40% cellulose (Sarnklong, C., et al, 2010).

Wheat straw: Wheat waste contains widely variable amounts of total nitrogen from 0.77-1.45%.

Sugarcane bagasse: Sugarcane bagasse contains 30% cellulose, 56% hemicelluloses, 13% lignin, 0.55% sugar, 36% Carbon, 0.448% nitrogen. The present investigation therefore aimed to study the influence of various agricultural wastes on the growth and yield of *P. sajor-caju* without any nutrient supplementation.

Materials and Methods: The required culture of oyster mushroom was obtained from Akshar Foods & Feeds Limited, Rasalpura, and Indore. (M.P.) and was grown on the potato dextrose agar (PDA 200 g/l diced potatoes; 20 g/l glucose, 15 g/l agar) medium at 25 °C for regular subculture. *P. sajor-caju* spawn was prepared in 850-ml polypropylene plastic bottles filled with cotton seed hull 87%, wheat bran 10%, sucrose 1%, plaster stone 1%, and calcium superphosphate 1% (w/w, in terms of dry weight) and subsequently sterilized at 121 °C for 80 min in autoclave. After cooling down to room temperature, the sterilized cotton seed hulls of every bottle were

inoculated with 5 cm^2 mycelial agar discs. The spawn was incubated in the laboratory at 26 ± 2 °C and 70% relative humidity for two weeks.

Substrate preparation, inoculation and incubation: The wheat straw, paddy straw, sugarcane bagasse, straws were completely dried under the Sun, and then chopped into small pieces of 1-2cm and soaked in water for overnight. After removal of the excess water, they were used as substrate in order to determine suitable substrates and suitable ratios for the farming of oyster mushroom. Dry weight of the substrates were noted before soaking and the bags full of different substrates weighed and were maintained at 1.5 Kg in a bag for each substrate. These inoculated bags were placed in growth room with 70-80% humidity and between 25-300C temperatures, for impregnation of the substrate with mushroom spawn i.e. spawn running. Growth of mushroom was recorded daily for all the treatments. When such bags become full of growth and pin-heads started appearing, the bags were opened to facilitate the development of fruiting bodies. As soon as the fruiting bodies developed and attained their full size, they were cut just above surface of the substrate with sharp knife or blade. The yield parameters recorded were, days taken for the completion of spawn running, time (days) taken for the first appearance of pin-head formation, time (days) taken for the maturity of fruiting bodies, number of flushes, time interval (days) between flushes and yield of fresh mushroom on different crop wastes.

Results And Discussion: The summary of results regarding the completion of mycelium growth, spawn running, pin-head formation, maturity of fruiting bodies, number of flushes of fruiting bodies, and yield performance of *P. sajor-caju* on different substrates are mentioned in Table II. On sugarcane bagasse spawn running was completed earlier in 20 days followed by paddy straw. Wheat straw took maximum time period which was 43 days. In case of pin-head formation sugarcane bagasse was better substrate (Table II). It was observed that time taken for first appearance of pinhead after spawning on the substrate was 23 days. It was followed by cotton waste 32 days. Maximum time 46 days were taken in case of wheat straw. In case of the maturity of fruiting bodies it was revealed that the minimum numbers of days were taken on the sugarcane bagasse (27 days), which proved to be the best substrate followed by rice straw (37.7 days). Maximum time period (50.7 days) was required for the maturity of fruiting bodies in case of wheat straw. Flushes of mushroom production varied among different substrates. The maximum flushes were on wheat and cotton waste (3.3). In case of *P.sajor-caju*, yield was 42.3 g on sugarcane bagasse.

Among the three substrates for the cultivation of oyster mushroom, sugar cane and rice straw gave the faster mycelial growth rate, time to primordial formation, time to first crop than wheat straw. In the present study oyster mushroom on rice straw and wheat straw substrate have less yield. Similar type of results were also obtained by many workers from different parts of the globe(Yang, W., et al,2013, Naraian, R., et al,2009, Zhang, R.Y., et al,2014) but lower than some reported cultivation which have relatively good yields (Obodai and Vowotor, 2003). The reason may be physical nature and high C/N ratio of rice straw and wheat straw that were not suitable for the cultivars of oyster mushroom (.Yang, W., et al, 2013, Girmay, Z., et al,2016). Rice or wheat straw substrate in the present study was also found to be very vulnerable to drying with high porosity as reported by Wang, L.et al,(2016) which affected sporophore formation.

Based on the investigations, it can be concluded that yield of oyster mushroom, *P. sajor-caju* appeared earlier on sugarcane bagasse followed by rice straw and the maximum flushes were obtained from wheat straw. The minimum flush was taken on paddy straw and the maximum yield on fresh basis was obtained from wheat straw.

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Table I: Chemical composition of Substrates

	Chemical composition (% w/w)			
Substrate	**Cellulose**	**Hemi cellulose**	**Lignin**	**Total nitrogen**
Sugarcane bagasse	8.34	30	56	0.448
Wheat straw	40	39	13	0.77
Paddy straw	39.2	23.5	36.5	0.457

Table II: Time taken for growth and yield of *P.sajor-caju* on different substrates

Substrates	Spawn running (in days)	Pin head formation (in days)	Maturation of fruiting bodies (in days)	Number of flushes	Yield (g)
Wheat straw	44.2a	46.8a	51.1a	3.4a	38.6a
Paddy straw	41.5a	44.2a	49.8a	3.1a	40.4a
Sugarcane bagasse	20.0a	24.0a	26.8a	3.0a	41.1a