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Importance and Effect of Substrate for the Cultivation of Pleurotus Sajor-Caju

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Abstract: ***A different types of agro- industrial lignocellulosic materials are used as substrates for the production of Pleurotus spp. with varieties of experimental conditions with variation in yield and biological efficiency. Non-composted, chopped and water-soaked straw is sufficient for the cultivation of Pleurotus spp., Since the carbon sources utilized by basidiomycetes are usually of a lignocellulosic character, fungi during vegetative growth produce a wide range of enzymes to degrade the lignocellulosic substrates. Both pasteurized and sterilized substrate of a wide range of residues can be used and no casing is required.***

Keywords: Pleurotus sajor-caju, Substrate, Compost, Mushroom, Humidity.

1. Introduction

Oyster mushroom is the third most popularly grown mushroom in the world and ranks second in India. Pleurotus species (like P. ostreatus, P. sajor-caju, P. pulmonarius, P. eryngii, P. cornucopiae, P. tuber-regium, P. citrinopileatus and P. flabellatus) are commercially very important edible mushrooms, found all over the world.

Pleurotus spp. can be grown using various agricultural waste materials. The different species of Pleurotus grow within a temperature range of 20^0 to 30^0 C hence is becoming increasingly popular in both tropical and sub-tropical countries. In India, the cultivation of this mushroom is picking up at an alarmingly high rate due to ease of its cultivation. The most important step in the cultivation of this mushroom is the pasteurization of huge quantities of raw material without which the competing moulds during spawn run could not be eliminated. P. sajor-caju can tolerate temperature up to 30^0 C although it fruits faster and produces larger mushroom at 25^0 C.

2. Significance of substrates in cultivation

A significant number of agro- industrial lignocellulosic materials are used as substrates for the production of Pleurotus spp., like corn cobs, various grasses and leaves, reed stems, maize and sorghum stover, rice and wheat straw, vine shoots, cardboard and paper, wood sawdust and chips, coffee pulp, cottonseed hulls, peanut shells, sunflower seed hulls, sugarcane and tequila bagasse etc. Substrate used for cultivation of Pleurotus sajor caju is listed in table given below. The genus Pleurotus comprises some the most popular edible mushrooms due to their favourable organoleptic and medicinal properties, fast mycelial growth and undemanding cultivation conditions. These mushrooms are commercially grown on pasteurized straw-based substrates or hardwood sawdust, fermented or not, with added supplements. However, as these fast-growing mushrooms display a complete lignocellulolytic enzyme system (Bushwell et al. 1996, Elisashvili et al. 2007), they can use a wide spectrum of agricultural and industrial wastes that contain lignin and cellulose for growth and fruiting (Poppe 2000). A wide variety of lignin degradation efficiency and selectivity abilities, enzyme patterns and substrates enhancing lignin degradation are reported from white-rot fungi (Hatakka 2001). An interesting category of white-rot fungi are selective degraders that degrade lignin rather than cellulose, like Pleurotus spp., which are used in a wide range of biotechnological applications (Cohen et al. 2002). Lignin degradation by these fungi is thought to occur during secondary metabolism and typically under nitrogen starvation (Hammel 1997). Since the carbon sources utilized by basidiomycetes are usually of a lignocellulosic character, fungi during vegetative growth produce a wide range of enzymes to degrade the lignocellulosic substrates.

Two particular basidiomycetes mushroom genera that have received considerable attention for their nutritional value, medicinal properties and biodegradation abilities are Pleurotus and Lentinula (Elisashvili et al. 2008). These widely cultivated edible mushrooms are efficient colonizers and bio converters of lignocellulosic agro- industrial residues into palatable human food with medicinal properties (Zervakis and Philippoussis 2000, Philippoussis et al. 2004, Zadrazil et al. 2004, Silva et al. 2007, Gregori et al. 2007). The efficacy of this value-added biocon- version process and the productivity of the mushroom crop are assessed by the biological efficiency (Chang et al. 1981). Biological efficiency (BE) expresses the bioconversion of dry substrate to fresh fruiting bodies and indicates the fructification ability of the fungus utilizing the substrate (Fan et al. 2000a). BE is calculated as the percentage ratio of the fresh weight of harvested mushrooms over the weight of dry substrate at inoculation (Chang and Chiu 1992, Philippoussis et al. 2001b, Diamantopoulou et al. 2006).

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Substrate should hold the water; that will be the water in the mushrooms, but some water will also evaporate and some will form from metabolism. The substrate should hold water tightly because we want air and if the water is not held and flows, it will plug the air spaces and growth will be limited. Soft materials used in substrate, often pack so tightly that although they hold water tightly, there is still no air space. If a material that packs tightly is used for substrate, it is especially important to mix it with another substrate that provides space for air. Straw is among the best substrates for providing air. Some substrate will need a preliminary treatment. Straw generally needs to be chopped. Paper will also need to be shredded. Maize cobs and stalks must be broken up. There are several reasons to shred things. The most important is to increase the surfaces where the mushroom mycelium can grow, but another is to make the substrate a little more compact and easier to handle.

Table 1: Different types of substrate used are listed in table

No	Substrates	Reference
1	Composted saw dust	M.Obodai et al.,2002
2	Wheat straw, soybean straw and groundnut shells	Mane et al .,2007
3	Wheat straw	Mandhre et al., 2008
4	Domestic waste (vegetable biomass from bitter gourd, chili, cowpea, French bean, potato)	Ganeshan et al., 1989
5	Waste paper	Baysal and Packer., 2001
6	News paper and used tea leaves	Jain.,2005
7	Paddy straw with combination of oilseed rape	Ahma et al. ,2008
8	Lignocellulosic substrates conventional viz . wheat straw (WS), paddy straw (PS) and soybean straw (SS), and non-conventional substrates viz . domestic wastes (DW), used tea leaves (UTL) and news paper waste (NPW) supplemented with soybean bran and groundnut bran	Poonam et al.,2011
9	Maize stalk, pea residue and banana leaves including two supplements viz. rice bran and chicken manure	Chandra P. Pokhrel et al.,2013
10	Paddy straw, Wheat straw, Apple leaves and Chinar leaves	Shauket et al.,2012
11	Wheat straw,Paddy straw, Sugarcane baggases, Sugarcane leaves, Black gram straw,Sorghum leaves, Maize heart, Ashoka leaves, Banana leaves, Barley straw, Sorghum stalks and Mustard straw	Pandey R. K et al.,2008
12	Soybean straw, paddy straw, wheat straw, groundnut straw, Pigeon pea stalk and sunflower stalk	S.S.patil.,2012
13	Cotton waste , paddy straw and wheat straw	Jawad Ashraf et al.,2013
14	Wheat straw	Shubhra Shukla and A. K. Jaitly.,2011
15	Soybean straw	Arun ingale and Anita ramteke.,2010
16	Sawdust, corn cob and coconut husk	Nurudeen et al.,2013
17	Paddy straw, lemon grass, sabai grass and kash grass	Shyamal et al.,2011
18	Wheat straw, paddy straw, soybean straw, pigeon pea straw and green gram straw	Survase D.M.,2012

M.Obodai et al.,2002 employed different substrate mixture. Eighty-eight parts of sawdust, was thoroughly mixed with ten parts of rice bran and one part each of calcium oxide and NPK fertilizer (23:15:5), and get good result.Mane et al .,2007 used wheat straw, soybean straw and groundnut shells for the cultivation of P. sajor-caju and best result was obtained with wheat straw. Mandhre et al., (2008) also used wheat straw for the growth of P.sajor-caju and obtained good results. Ganeshan et al., (1989) used domestic waste (vegetable biomass from bitter gourd, chili, cowpea, French bean, potato) for the growth of P. sajor-caju and obtained best resuts. Baysal and Packer (2001) used waste paper for the growth of P. sajor-caju and obtained average yield. Jain (2005) also used news paper and used tea leaves for the growth of P. sajor-caju and found good results with used tea leaves. Ahma et al. ,(2008) reported 63% biological efficiency of P. sajor-caju cultivated on paddy straw with combination of oilseed rape. Poonam et al.,2011 used medium that was prepared using conventional viz . wheat straw (WS), paddy straw (PS) and soybean straw (SS), and non-conventional substrates viz . domestic wastes (DW), used tea leaves (UTL) and news paper waste (NPW). Among the three conventional substrates, significantly higher yield was obtained from SS substrate, followed by WS and PS. Supplemented with Soybean bran yielded better results than groundnut bran. Among these non conventional substrates, significantly higher yield was obtained from DW, followed by UTL, and NPW. Soybean bran yielded better results than groundnut bran. Here, also supplementation of 3% of soybean bran and ground nut bran enhanced the yield of oyster mushroom.Chandra P. Pokhrel et al.,2013 had done experiment with maize stalk, pea residue and banana leaves. Each substrate was separately supplemented with 10 % chicken manure or rice bran and mixed thoroughly; substrate without supplement was considered as a control. The total yield in maize stalk with rice bran was highest followed by control and chicken manure respectively. The total yield in pea residue with rice bran was highest followed by chicken manure and control, respectively. The total yield in banana leaves with rice bran was highest followed by chicken manure and control. The substrate materials viz. Paddy straw, Wheat straw, Apple leaves and Chinar leaves was used by Shauket et al.,2012 Highest yield was found on Paddy straw substrate followed by Wheat straw, Apple leaf and Chinar leaf substrate. A variety of agricultural wastes used by Pandey R. K et al.,2008, namely wheat straw, paddy straw, sugarcane baggases, sugarcane leaves, black gram straw, sorghum leaves, maize heart, ashoka leaves, banana leaves, barley straw, sorghum stalks and mustard straw. Among the all substrate paddy straw resulted the highest yield followed by wheat straw, black gram straw.The agro waste had been experiment by S.S.patil.,2012, soybean straw, paddy straw, wheat straw, groundnut straw, Pigeon pea stalk and sunflower stalk. Jawad Ashraf et al.,2013 done cultivation with cotton waste, paddy straw and wheat straw.Shubhra Shukla and A. K. Jaitly.,2011. The substrate used for this experiment was wheat straw and Arun ingale and Anita ramteke.,2010 used soybean get best result.Substrates preparation and Cultivation with, the highest yield was found in corn-cob followed by sawdust and coconut husk respectively, Nurudeen et al.,2013.Just after flowering, the aerial parts of the grasses viz., lemon grass, sabai grass and kash grass by Shyamal et al.,2011 paddy straw gave maximum yield.Wheat straw, paddy straw, soybean straw, pigeon pea straw and green gram straw were used for cultivation of oyster mushroom by Survase D.M.,2012.

Peurotus sajor caju has very good efficiency of Residue Conversion to Fruiting bodies as it can grow varieties of substrate.These is a widely cultivated edible mushrooms, efficient colonizers and bioconverters of lignocellulosic agro- industrial residues into palatable human food with addition advantage to human health.Although it can grow on different lignocellosic materials, it has excellent efficiency to produce residue in to biomass. These mushrooms present several advantages related with rapid mycelial growth, high ability for saprophytic colonization, simple, inexpensive cultivation techniques and several kinds of species available for cultivation under different climatic conditions.

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