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Evaluation of Various Lignocellulosic Products for the Cultivation of Shiitake Mushroom [*Lentinula edodes* (Berk.) Pegler]

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A B S T R A C T

Mushroom cultivation is gaining popularity in recent times because of its medicinal and nutritive value. Shiitake mushroom which is popularly known for medicinal property is cultivated worldwide and also gaining importance in Indian conditions. The large scale agro residues generated in India is not utilised economically and hence this investigation was carried out on such agro residues. Evaluation of the mycelial growth of *L. edodes* on the different agro-residues was studied and sorghum straw showed the fastest colonization of the shiitake (strain OE-388S) within 25.6 days and the slowest rate of colonization was exhibited by saw dust + sorghum straw combination (44.6 days).

Introduction

India is known for the large cropping diversity with vast variety of agricultural crops grown every year leading to the enormous production of agro wastes like crop residues, tree wastes, and weeds of land and aquatic system which make the potential renewable resources. Numerous methods have been implemented for the better exploitation of agro wastes in which one among them being Mushroom cultivation. Shiitake mushroom species are the edible and medicinal mushroom which has originated from East Asia. It contributes around 25 percent of aggregate yearly generation of mushrooms over world and China represents roughly 90% of the world's shiitake mushroom (Chang and Miles, 2004). The shiitake mushroom cultivation has expanded from 14.3 percent to 25.2 percent and 180 thousand metric tons to 1564.4 thousand metric tons worldwide in the last three decades. While in India it has increased from 1000 metric tons to 1250 metric tons (Singh and Mishra, 2006).

Shiitake has good amounts of protein (18%), potassium, niacin and B vitamins, calcium,

magnesium and phosphorus with antiviral and resistance boosting properties and utilized nutritiously to battle infections, bring down cholesterol and direct pulse. Shiitake mushrooms develop on rotting wood of hardwood trees and have generally been developed on short length cut logs. Currently it has demonstrated fruitful on both logs and option substrates like wood shavings and peat greenery (Royse 2001). It is having the potential to convert inexpensive ligno-cellulosic substrates into valuable protein at a low cost.

The availability of the agro-residues after crop harvest like straws of various crops as that of wheat, sorghum, bajra, rice has been used as a basal substrate for the cultivation of shiitake in recent times. The present investigation was carried out to find out the best source for the cultivation of shiitake mushroom in Indian conditions.

Materials and Methods

Culture used for the study

The pure culture of *L. edodes* strain OE-388Swas used for the present investigation obtained from Directorate of Mushroom Research (DMR), Solan and from Punjab Agricultural University (PAU), Ludhiana and were subsequently evaluated for the growth and development parameters.

Preparation of Potato Dextrose Agar (PDA) media

Potato dextrose agar (PDA) medium was prepared by using 200 g peeled potato, 20 g dextrose and 20 g agar in a litre of water. A small bit/disc of tissue was collected from the pure culture of shiitake mushroom and transferred on the sterilized PDA medium under aseptic conditions. This was incubated at 25±2 ^{O}C for 7-10 days for sufficient mycelial growth. Pure cultures were obtained by sub culturing.

Evaluation of the *L. edodoes* mycelial growth on the different agro-residues

An experiment was conducted using CRD design with 3 replications using various agro-residues as treatments for mycelial run. Wheat straw, sorghum straw, pearl millet straw were soaked for overnight period and sawdust for 48 hrs. Then the excess water was drained to maintain moisture at 65 per cent. The moisture content of the mixture was estimated by pressing a handful of mixture. If no drop of water escaped, the moisture content was considered appropriate.

The substrate formulation was filled in poly propylene bags and sterilized in the autoclave at 121 °C for 90 minutes. After cooling of the substrate a 10mm mycelial disc was collected from the culture of OE-388 S strain of the shiitake mushroom using cork borer and placed on the sterilized substrate under aseptic conditions. Then the bags were kept for spawn run in growing house. This was incubated at 25±2^{o} C for several days for sufficient mycelial growth until it completely colonizes the substrate.

Different type of agro-residues used

Wheat straw (WS)
Sorghum straw (SS)
Pearl millet straw (BS)
Saw dust (SD) + Wheat straw (WS) (8:2)
Saw dust (SD) + Sorghum straw (WS) (8:2)
Saw dust (SD) + Pearl millet straw (BS) (8:2)

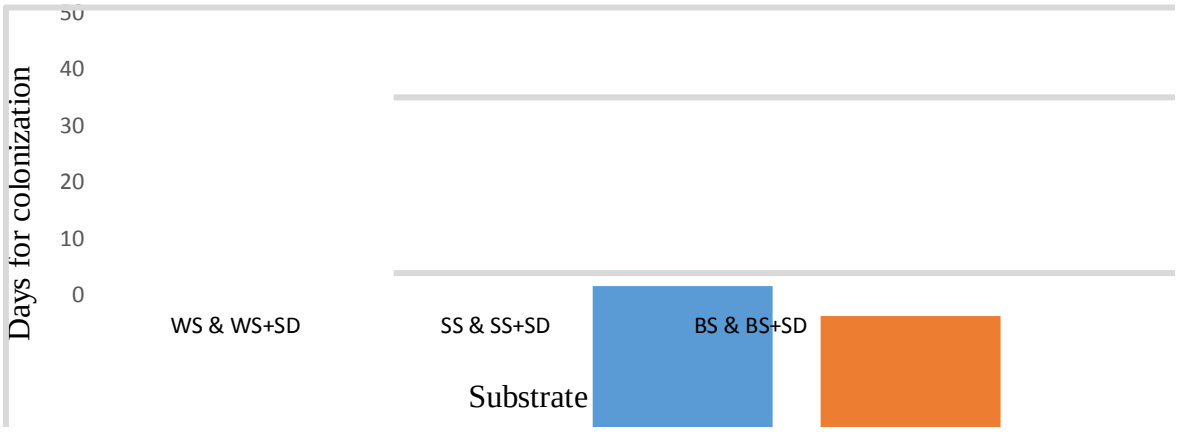
Results and Discussion

After transferring a 10mm mycelial disc the substrates (200g) were incubated inside the BOD and days taken for complete colonization was recorded as shown in table 1.

Fig.1 Mycelial run of Shiitake on different agro residues

Table.1 Mycelial growth of *L. edodes* on the different agro-residues

Substrate	Days for colonisation
Wheat straw	39.3
Sorghum straw	25.6
Pearl millet straw	28.6
Saw dust + wheat straw	37.6
Saw dust +sorghum straw	44.6
Saw dust + pearl millet straw	39.6
CD (p = 0.05)	**3.3**



Sorghum straw showed the fastest colonization of the shiitake (strain OE-388S) within 25.6 days which exhibited a significant difference with other substrates and their combinations except Pearl millet straw (28.6 days). The slowest rate of colonization was exhibited by saw dust + sorghum straw combination (44.6 days) (Fig. 1).

The order of preference for earliest colonization was sorghum straw, Pearl millet straw, wheat straw, saw dust combined with wheat straw, Pearl millet straw and sorghum straw respectively. There was a significant difference between the most of the treatments except between sorghum (25.6 days) and pearl millet straw (28.6 days) and saw dust with wheat (37.6 days) and pearl millet straw (39.6 days).

Sorghum straw showed the fastest colonization of the shiitake (strain OE-388S) within 25.6 days which exhibited a significant difference with other substrates and their combinations except bajra straw alone (28.6 days). The slowest rate of colonization was exhibited by saw dust + sorghum straw combination (44.6 days). These results were in accordance with the results obtained by Sharma (2013), where he found that the days for spawn run were less in wheat straw substrate as compared to saw dust substrate alone.

Puri *et al.,* (2011) used two different strains L1 and L2 for cultivation on different saw dusts and agricultural wastes alone and in combinations with one another. The mixture of wheat straw and poplar saw dust (1kg) showed minimum time for colonization (55 days) whereas the maximum time for colonization was observed (85 days) in the mixture of sal and coir pith. These results supports the facts of the current experiment as 200g substrate took less time period as compared to 1kg substrate used.

The growth of mycelium on saw dust combinations which took 37 to 44 days on sorghum to wheat with saw dust in the current investigation was supported by the findings of Ashrafuzzaman *et al.,* (2009) where he cultivated the Shiitake on jackfruit sawdust and Shiitake mushroom found to be needed 43 days to complete mycelial growth on sawdust of jackfruit while other substrates took up to 55 days.

Similarly, Philippoussis *et al.,* (2005) has grown *Lentinula edodes* strain S4080 on seven oak-wood sawdust substrates (OS), supplemented with wheat straw (WS) or corn-cobs (CC)and the colonization rate studies showed faster colonization on OS supplemented with WS or CC in a ratio of 1: 2 (OS: supplements).

The days for colonization from 25 to 44 days are in accordance with Kalberer (1998) where he compared incubation periods of 30, 35, 40 and 47 days and found the optimum period to be 35 days, with yields significantly reduced after 47 days.

From the observations it was concluded that the high carbohydrate content of millets like sorghum might favoured the colonization by fungus in comparison to other substrates.

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