YIELD PERFORMANCE AND ELEMENT PROFILING OF DIFFERENT STRAINS OF *LENTINULA EDODES* (BERK.) PEGLER

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ABSTRACT

Among five strains OE-388 took minimum period of 62 and 58 days for spawn run and produce maximum number of sporophore i.e. 80.16 and 69.50 and yield i.e. 2468.33 and 2070.50 g/800 g wheat straw which is significantly higher than the yield obtain from other strains in two seasons, respectively. Whereas strain OE-28 showed poor result in terms of taking maximum days for spawn run i.e. 68 days and produce minimum number of sporophore i.e. 65.67 and 47.33 and poor yield 830 and 715.67 g/0.8 kg wet wheat straw as compair to other strains. Amongst the five strains OE-388 contains high value of magnesium (109.51 mg/100 g dry wt.), iron (3.83 mg/100 g dry wt.), zinc (7.71 mg/100 g dry wt.), manganese (4.59 mg/100 g dry wt.) and copper (1.5 mg/100 g dry wt.) followed by OE-28. However toxic elements were not detected in any strains.

Keywords: mushrooms, shiitake, *Lentinula edodes*, lentinan, element profiling

INTRODUCTION

Lentinula edodes (Shiitake mushroom) is the third most important edible mushroom in the world from the stand point of production after *Agaricus bisporus* and *Pleurotus* spp. It accounts for 17% of world production in terms of weight [1, 2]. It is one of the most popular medicinal mushrooms. It has high content of proteins, fibers, vitamins, minerals and low content of lipid specifically cholesterol [3]. It has been reported to boost the immune system, lower cholesterol, function as an anticoagulant and may have use in treatment of some cancers as it contains lentinan, a polysaccharide with strong anti-cancer properties [4, 5]. Mushrooms depend on substrates for their nutrition and the substrate is normally a source of lignocellulose material which supports growth, development and fruiting body of mushroom [1]. Shiitake mushroom is traditionally cultivated on the shii tree [*Castanopsis cuspidate* (Thunb.) Schott] or wood logs in Japan. Scarcity of theshii tree has necessitated a search for alternative substrates for shiitake cultivation. Large amounts of freely available wheat straw and sawdust offer a potential alternative substrate for mushroom cultivation.

Minerals (element) represent the ash left behind after complete incineration of the dry mushroom.The nutritive composition of the mushroom varies with species, strain, type of substrate on which it is grown, the maturity of the fruiting body, the method of analysis and the environmental conditions in which it is grown [6]. Minerals are very important because it is a co-factor of several enzymatic systems, being the most abundant macro-element in mushrooms [2, 7, 8]. Minerals such as iron, zinc, copper and manganese are essential metals since they play an important role in biological systems, whereas lead, nickel, arsenic and cadmium are nonessential metals as they are toxic, even in traces [9]. However, sodium is relatively less in mushroom species, thus mushrooms are said to be good for patients at hypertension [10].

In this context it is worthwhile to evaluate the available strains for their yield and metal content of the mushroom and assess the contribution of shiitake mushroom to the daily. The present study is focused on the analysis of five strains of shiitake mushroom for their yield performance on wheat straw and mineral composition.

MATERIALS AND METHODS

Yield performance of strains

The cultures of five strains of *Lentinula edodes* (OE 16, 22, 38 & 388) were obtained from Mushroom Research and Training Centre, Pantnagar (original source: DMR, Solan) and maintained using PDA medium at 25 °C. The spawn was

prepared using wheat grains as base material. The substrate wheat straw supplemented with 10% wheat bran was used to evaluate in two consecutive year.

The substrate was soaked in water for 16 h then taken out and kept for 2-3 h to drain out the excess and allowed to dry in shade for 6 h wet substrate (2 kg) filled in polypropylene bag, sterilized at 22lbs psi for 90 minute and allowed to cool down at room temperature. The sterilized substrate (bags) was inoculated aseptically by wheat grain spawn @5% on wet weight basis of the substrate. The bags were incubated in cropping room at 23±1 °C temperature and 80-85% RH for spawn run. After complete spawnrun bag were cut open to expose the upper surface for fruiting and relative humidity of the cropping room maintained at 85-90% by sprinkling water twice or thrice a day. The observation recorded for spawn run period, number and weight of sporophores and average weight per fruitbody. Fruit bodies were harvested after maturity and biological efficiency (BE%) was calculated. BE (%) = (Fresh weight of fruit bodies/dry weight of substrate) x 100.

Element profiling

The fruting bodies of these mushrooms have been analysed for their element contents. Mushrooms were harvested at early maturing fruiting stage. The fruiting bodies of mushrooms were oven dried at 60 °C for 1 hr and grounded in the blender. Fresh dried mushroom was used for nutritional analysis.

Total ash (1g of dried mushroom was burned in muffle furnace at 600 °C for 8 hrs) was taken for the analysis of mineral content 2 ml of conc. nitric acid was added to the ash and heated for 2 min. one drop of hydrogen peroxide was added into the solution to remove turbidity. The solution then transferred into a volumetric flask and total volume was made 50 ml by adding deionised water. This was then used to analyse the contents of Cu, Fe, Zn, Mg, Cr, Mn, Ni and As by flame and graphite method with atomic absorption spectroscopy.

Statistical analysis: All the analyses were performed in triplicates, and these results were reported as means ± standard deviation (SD).

RESULTS AND DISCUSSION

The data revelaed that out of five strains tested OE-388 took minimum period of 60 days for spawn run and produce maximum number of sporophore i.e. 74.83 and yield ie. 2269.54 g/2.5 kg wheat straw which is significantly hgiher than the yield obtain from other strainin with mean 90.78% biological efficiency. Whereas strain OE-28 showed poor result in terms of taking maximum period for spawn run i.e. 68 days and produce minimum number of sporophore i.e. 56.5 and poor yield 772.84 g/2.5 kg wheat straw as compared to other strains with 30.92% mean biological efficiency (Table 1). Very low yield with 6% biological efficiencywas obtained in saw dust [11]. It was reported that the biological efficiency of shiitake mushroom on wheat straw ranged from 25-56 per cent [12]. It was found that the shiitake mushroom strain L_1 and L_2 yielded maximum on wheat straw with 30% and 24% biological efficiency, respectively [13].

The fruting bodies of these strain mushrooms have been analysed for their element contents i.e. One major element (Mg), four trace elements (Fe, Mn, Zn and Cu) and two toxic elements (As and Cr) by using Atomic absorption spectroscopy.It was found that the strains OE-388 contains high value of magnesium (109.51 mg/100g dry wt), iron (3.83 mg/100g dry wt), zinc (7.71 mg/100g dry wt), manganese (4.59 mg/100g dry wt.) and copper (1.5 mg/100g dry wt.) followed by strain OE-28. Minimum value of Mn (1.09 mg/100g dry wt), Cu (0.87 mg/100g dry wt) and Fe (1.27 mg/100g dry wt) was found in OE-16 whereas least value of Mg (91.49 mg/100g dry wt) and Zn (5.08 mg/100g dry wt) was obtained from OE-38. However toxic elements (As & Cr) were not detected in any strains.

The Mg and Zn content recorded in the strains of shiitake mushroom were similar with the earlier findings [14-16]. Mg contents in these strains are high which is beneficial for human health. Shiitake mushroomis also good source of micro- and macro elements, such as K, Mg, P, Zn, Fe, or Cu [17].

Table 1. Yield performance of different strain of Shiitake mushroom (*Lentinula edodes*) on wheat straw

Strain	Days taken for spawn run			Avg. yield (g/2.5kg dry substrate) from 40 days harvesting						Wet per fruit body (g)			Biological efficiency (%)		
	2011	2012	Mean	Number			Weight			2011	2012	Mean	2011	2012	Mean
				2011	2012	Mean	2011	2012	Mean						
OE-16	67	63	65	69.17	60.66	64.915	1010	922.67	966.34	14.60	15.21	14.91	40.4	36.91	38.66
OE-22	66	59	62.5	77.33	67.5	72.415	1380	1282.5	1331.25	17.85	19.00	18.43	55.2	51.3	53.25
OE-28	68	68	68	65.67	47.33	56.5	830	715.67	772.84	12.64	15.12	13.88	33.2	28.63	30.92
OE-38	66	61	63.5	70.17	63.33	66.75	1090	1016	1053	15.53	16.04	15.79	43.6	40.64	42.12
OE-388	62	58	60	80.16	69.5	74.83	2468.33	2070.5	2269.45	30.79	29.79	30.29	98.73	82.82	90.78
CD at 5%	-	-	-	11.40	719.18	-	14.19	284.5	-	-	-	-	-	-	-

Table 2. Element concentration (mg/100g on dry weight basis) in strains of *Lentinulaedodes* (shitake mushroom)

Elements	Strain				
	OE-16	**OE-22**	**OE-28**	**OE-38**	**OE-388**
Major Elements					
Mg	104.92±0.78	99.74±0.73	100.32±0.58	91.49±0.75	109.51±0.53
Trace Elements					
Mn	1.09±0.01	3.88±0.12	4.49±0.46	1.86±0.28	4.59±0.56
Zn	7.38±0.19	7.50±0.12	7.42±0.05	5.08±0.13	7.71±0.07
Cu	0.87±0.18	1.33±0.13	1.23±0.11	0.95±0.08	1.50±0.07
Fe	1.27±.09	3.12±0.15	3.62±0.24	2.98±0.28	3.83±0.25
Toxic metal					
As	0.00	0.00	0.00	0.00	0.00
Cr	0.00	0.00	0.00	0.00	0.00

Each value is the mean of three replicate determinations ± standard deviation

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