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RESEARCH PAPER

Impact of various sterilization methods on growth and yield of oyster mushroom (*Pleurotus florida*)

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Abstract : Oyster mushrooms (*Pleurotus* sp.) are one of the most appreciated mushrooms due to their high nutritional value, flavour, very good taste and medicinal value. It is grown in various lingo-cellulosic agro wastes thereby reduce the environmental pollution caused by its decomposition. In the process of mushroom cultivation, one of the most important aspects is the disinfection of the substrates. In the present study different substrate sterilization methods *viz.,* hot water treatment for 30 min., autoclaving at 15lbs pressure for 20 min, treatment with formaldehyde solution (50ml/ ltr.water), treatment with bavistin (2g/ltr. water) and treatment with ordinary water (control) were investigated. Paddy straw was used as the substrate for mushroom cultivation. In the investigation, it was found that substrates sterilized by autoclaving was the best as it took less time for spawn run (15.0 days), pin head formation (20.3 days), fruiting body formation (23.3 day) and produced the highest mushroom yield per bed (892.35g) with biological efficiency of 89.24 per cent. Substrates sterilized with bavistin (890.25g/bed) and hot water (886.23g/bed) also produced good yield of mushroom which was comparable with those produced in autoclave sterilized substrate. Formaldehyde treatment behaved poorly as it took highest time for spawn run. As autoclaving of huge quantity of substrates in big farms is not convenient, chemical sterilization with bavistin can be practiced.

Key Words : Mushroom, Substrate, Sterilization, Yield

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INTRODUCTION

Mushrooms have existed for millions of years and mankind has regarded them as a valuable food. Mushrooms with their flavour, texture, nutritional value and with very high productivity per unit area have been rightly identified as an excellent food source to fight malnutrition in developing countries. Mushroom normally ranges between 20 and 40 per cent in protein (Sharma and Madan, 1993) and also contains all the essential amino acids. It is low in total fat content and have a high proportion of polyunsaturated fatty acids (72 to 85 %) relative to total fat content. Mushroom is high in fibre content and folic acid. It also contains high quantity of linoleic acids. For all of these goodness mushrooms are considered a health food. Oyster mushroom (*Pleaurotus* spp.) is very easy to cultivate and various agricultural wastes are being used as substrates for its cultivation. Cultivation of edible mushrooms might be the only current process that combines the production of protein-rich food with the reduction of environmental pollution (Sanchez, 2010). It represents one of the most efficient biotechnological processes for lignocellulosic organic waste recycling (Mandeel *et al.*, 2005). Some of these wastes include banana leaves, sugarcane bagasse, tea wastes, pine needles, coconut leaves, wheat straw and rice straw (Thomas *et al*., 1998). Sterilization of the mushroom substrate is one of the important steps in mushroom cultivation. Different sterilization methods can be used for cultivation of oyster mushroom and its yield improvement

(Khan *et al.*, 2011). Using such appropriate methods, spawning will assure better resistance against any disturbance of competitive micro-organisms. The present study aimed to investigate the sterilization methods using different substrates for their effective utilization by cultivation of oyster mushroom.

MATERIAL AND METHODS

In the present investigation on different substrate sterilization methods *viz.*, hot water treatment for 30 min., autoclaving at 15lbs pressure for 20 min, treatment with formaldehyde solution (50ml/ltr. water), treatment with bavistin (2g/ltr. water) and with ordinary water (control) were studied for their effect on the growth and yield of oyster mushroom (*P. florida*). The experiment was conducted in the Department of Plant Pathology, Biswanath College of Agriculture, Assam Agricultural University, Biswanath Chariali, during 2013-14 in a Completely Randomized Design (CRD) with three replications.

Preparation mushroom culture and spawn :

Culture of the strain of oyster mushroom (*Pleurotus florida*) was prepared by tissue culture method and the pure culture was maintained on Potato Dextrose Agar (PDA) medium. The spawn was prepared using paddy grain as spawn substrate.

Collection of mushroom substrate :

The substrate for mushroom cultivation (Paddy straw) was collected from the farmers field nearing B.N. College of Agriculture, Biswanath Chariali, Assam. The paddy straw after chopping into 3-4 cm length was stored under a covered shade.

Use of different sterilization methods :

Five different sterilization methods were used for sterilization of the substrates. They were :

T_1- Hot water treatment :

The substrates were first soaked in cool water for 12 hours, taken out form water after soaking. Water was boiled up to 85^0C, soaked straw was put in the hot water and boiled for 30 min

T_2- Autoclaving :

The substrates were first soaked in cool water for 12 hours, taken out form water, excess water drained out, filled in the polypropylene bags and the polypropylene bags filled with moist substrate were autoclaved for 20 mins. at 15 lbs pressure.

T_3- Formaldehyde treatment :

Paddy straw was treated by soaking in formaldehyde solution (50ml/ ltr.water) for 12 hours.

T_4- Bavistin treatment :

Paddy straw was treated by soaking in bavistin solution (2g/ ltr.water) for 12 hours.

T_5- Treatment with ordinary water (control) :

The substrates were first soaked in cool water for 12 hours.

Spawning and cropping of mushroom :

After sterilization, the straw was taken out from water, put in a slanting position to drain out the excess water or cooled in case of hot treatment and then bags were prepared. Polythene bags of 40×60 cm size were taken, perforated by making about 40 holes in each bag and used to put the spawn and substrates. The bagging was done by layer method by putting 3 per cent of spawn on wet weight basis of the substrate. Each bed contained one kilogram of paddy straw on dry weight basis. After completing spawning the bags were kept in dark room and necessary records were taken periodically. On completion of spawn run the poly bags were removed from the bed, kept in cropping room, watering was done regularly to keep them moist. The mushroom was harvested up to third flushes.

Recording of data :

Days for completion of spawn running :

Time was recorded in days for the completion of 100 per cent growth of mycelium on each substrate in polythene bags.

Days for the appearances of pinhead :

The data were recorded in days taken for appearance of mushroom primordial formation in substrates.

Maturation of fruiting bodies :

Time period was recorded in days from pinheads to maturation of fruiting bodies in all treatments.

Yield :

The data were recorded for the harvesting of mushroom up to three flushes. The first and respective harvesting was done at maturity and the yield of different flushes of fruiting bodies was noted.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Spawn running :

The results depicted in Table 1 reveal that autoclave sterilization gave the best performance among all the sterilization methods under study. The substrate sterilized by

Table1 : Effect of different substrate sterilization methods on growth and yield of oyster mushroom (*Pleurotus florida*)

Sterilization methods	No. of days required for			Yield/ bed (g)	Biological efficiency (%)
	Spawn run	Pinhead formation	Fruiting body formation		
Hot water (T_1)	16.0	22.7	26.0	886.23	88.62
Autoclave (T_2)	15.0	20.3	23.3	892.35	89.24
Formaldehyde (T_3)	22.7	25.7	30.0	660.47	66.05
Bavistin (T_4)	16.3	22.0	26.7	890.25	89.03
Ordinary water (T_5)	20.0	29.0	34.0	312.59	31.26
C.D. (P=0.05)	1.07	1.16	1.04	7.89	-

autoclave took 15 days for the spawn running which is followed by sterilization by hot water treatment (16 days) and bavistin (16.3 days). Highest time of 22.7 days was taken by substrate sterilized with formaldehyde.

Pin head appearance :

The time required for pin head appearance of *P florida* varied with the sterilization method (Table 1). Paddy straw sterilized by autoclaving required the shortest time of 20.3 days. This was followed by substrate sterilized by bavistin (22.0 days) and hot water (22.7 days). Substrate sterilized with formaldehyde took the longest time of 29 days. Similar observations of variation in the time taken for pin head appearance in different sterilization method of substrate were also made by Khan *et al.* (2011).

Fruiting body formation :

The minimum time required for fruiting body formation of *P. florida* was 23.3days when the paddy straw was sterilized with autoclaving (Table 1). This can be as a result of the shorter period of vegetative growth required by the mycelium grown on the material disinfected by autoclaving (T_2). This was followed by hot water treatment (26.0 days) and bavistin treatment (26.7 days). Substrates treated with ordinary water took the highest period of 34.0 days for appearance of fruiting body of mushroom.

Mushroom yield :

After analyzing the influence of disinfection method on the mushroom yield (Table 1) it is noticed that T_2 (substrate autoclaved at 15 lbs pressure for 20 min), T_4 (substrate sterilized with bavistin) and T_1 (substrate sterilized with hot water) recorded better yields than control which was 892.35, 886.23 and 890.25 g/ bed, respectively. The mushroom yield recorded in these three treatments did not differ significantly. The increased production of mushroom in these three sterilization methods may be due to a better protection of useful micro-organism realized in the case of these methods of disinfection comparative with treatment with formaldehyde treatment and treatment with ordinary water (control). The lowest yield (312.59 g/bed) was recorded for the T_5 (material without disinfection) and it is worth mentioning that in the beds prepared with substrates treated with ordinary water there is production of very negligible mushroom after the first flush. This situation may be the result of the negative influence of competitive micro-organism that have developed in the substrate with no disinfection on mushroom mycelia development. This very low production of mushroom proved that sterilization of cellulosic materials is absolutely necessary to obtain high yields for getting higher profit. Similar observations were also made by Ali *et al.* (2004) and Khan *et al*. (2011) in experiments conducted by using different methods of sterilization for mushroom cultivation. From the experiences gathered from the present experiment, it can be concluded that the methods of sterilization influenced the period of vegetation (spawn run), pin head appearance, fruiting body formation and yield of mushroom. Disinfection is necessary in order to reduce the number of micro-organisms in the substrate. As in a large farm autoclaving of huge quantity of substrate will be less convenient, chemical sterilization method can be easily adopted without sacrificing profit. Similar work related to the present investigation was also carried out by Narain *et al.* (2008) and Nelson and Sommers (1982).

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