CORRELATION BETWEEN THE SIZES OF POLYPROPYLENE BAGS AND THE YIELD OF *Pleurotus ostreatus*

Shahla Rashid, Muhammad Asif Ali, M. Imran Mehmood, M. Asif Hanif and Rashid Waseem
*Institute of Horticultural Sciences, University of Agriculture, Faisalabad. Pakistan.

This study was conducted to investigate the effect of different sizes of bags on the yield of oyster mushroom .The bags of different sizes were used (7x14″; 6x12″; 8x12″; and 9x14″). Spawn running, pin head, fruit body formation, and yield of oyster mushroom (*Pleurotus ostreatus*) were detrmined by using growth media of cotton waste supplemented with lime and wheat bran 4% each. Results showed that bag size in the (8x12″) and (9x14″) significantly affect the yield. The faster spawn running in the bag sized (8x12″) which took 30 days. Pinheads formation was maximum in the bag sized (8x12″) which gave 48.8 number. Maximum mature mushrooms were obtained in the bag sized (7x14″) 15.4 number. Total yield was maximum in the bag sized (6x12″) 69.2 gm.
Keywords: Oyster mushroom, polypropylene bag; cotton waste; yield; spawn running

INTRODUCTION

Oyster mushroom is one of the popular edible fungi cultivated in many countries in the sub-tropical and temperate zone. Oyster mushroom locally known, as "*Dhingri*" which grows wild on logs and stumps of trees in the forests of North Western Frontiers Province and Azad Kashmir and other plantations in the plains of Punjab and Sindh, during monsoon. It is the only one among the mushroom, which is called as "meat of the forest" due to its meat like taste and texture. It is consumed by local population and meets the requirements concerning the flavour and taste. Only a few species of this mushroom have been cultivated commercially.

Quimio (1976) observed the recovering effect of *Ganoderma lucidum*, on diabetes, ulcer, liver and lung diseases. Mushrooms are important due to their nutritive and medicinal values (Agrahar-Murugkar and Subbulakshmi, 2005; Cheung and Cheung, 2005). *Pleurotus spp*., grows wildly in tropical and subtropical rainforests, but can be cultivated artificially. It has high levels of proteins, carbohydrates, minerals (calcium, phosphorus, iron) and vitamins (thiamin, riboflavin and niacin) as well as low fat (Justo *et al*., 1998; Manzi, *et al*., 1999). The fresh mushroom contains 85-90% moisture, 3% protein, 4% carbohydrates, 0.3-4.0% fat and 0.1% mineral and vitamins (Tewari, 1986). Mushroom also contains considerable amount of phosphorus, potassium, copper and iron but low level of calcium (Anderson and Feller, 1942).

Oyster mushroom is commercially cultivated in Europe where it is sold at about double price of button mushroom. *Pleurotus spp* has been cultivated on substrates such as cereal straw, corn cobs, sawdust, bagasse, wood pulp, cotton and oil palm waste, banana leaves, coconut husks, poultry wastes, tree bark and leaves. A large quantity these of waste materials are also available in Pakistan (Anonymous, 2000). Garcha *et al.* (1985) reported efficiency of different containers like trays, baskets and perforated polyethylene bags for the cultivation of *Pleurotus species*. Polyethylene bags should better result regarding yield than the baskets and trays. A biological efficiency of 52-55 percent and 57-60 percent was attained for *Pleurotus florida* and *Pleurotus* sajor-caju, respectively in bags. Where as in baskets 35-37 percent biological efficiency was obtained. Yield was recorded in trays. Further more perforated bags rendered better yield than unperforated, and bag size had no effect on yield.

Shetty and Krishnamoorthy (1980) used polyethylene bags for the cultivation of *Pleurotus* sajor-caju on paddy straw. Mushroom mycelia enriched the paddy straw with protein which can be used as feed. The purpose of this work was to evaluate the growth performance, yield, and productivity of *Pleurotus* ostreatus strains in response to bag size. Oyster mushroom is easy to produce and therefore is a good choice for beginners. Farmers in Pakistan usually grow oyster mushroom as a part time activity. They usually use polypropylene bags of different sizes as containers for growing mushrooms, which result in large variation in their mushroom production therefore, the present studies were under taken to investigate the effect of variation in the sizes of polypropylene bags on the mycelial growth and fructification of oyster mushroom using cotton waste as a growing media.

MATERIALS AND METHODS

Culture of (strain P101) of *Pleurotus ostreatus* was revived from the Culture Bank of Mushroom Laboratory Institute of Horticultural Sciences, University of Agriculture Faisalabad. Culture maintained on media Potato Dextrose Agar (Potato starch 20g, Dextrose

20g, Streptomycin 1g and distilled water for one liter). For preparation of Spawn, medium was sterilized in autoclave at 15 lbs psi (121°C) for 30 minutes and was then poured in 1.5x15cm test tubes to make agar slants. To avoid bacterial contamination, streptomycin was poured into the sterilized medium at the rate of 1g/liter. The mother culture obtained from Mushroom Culture Bank was inoculated on agar slants with the help of inoculating needle. These test tubes were then incubated at 25°C for 7-10 days in an incubator.

Cotton waste was used as a base substrate, 4% Lime and wheat bran were chosen as supplementary activator substances to increase mushroom yield as well as achieve faster growth. Initially, cotton waste was water soaked to gain 75% moisture content (MC). The substrate was piled up, covered with plastic sheet and allowed to ferment for 5-7 days. Following the addition of the supplements to the cotton waste, the material was filled in by using Polypropylene bags with sizes 7x14″; 6x12″; 8x12″; and 9x14″. The bags were closed and tied up with the rubber bands and pasteurized at 121°C for 15 minutes and spawning was done in each bag at the rate of 5% of wet weight of the substrate. Spawn was placed on the top of the substrate. The bags were subsequently placed into a spawn running room at 25+2 °C under dark conditions. After completion of spawn running (mycelial development) the bags were placed into a growth chamber set environmentally at 15°C room temperature and 80–90% RH. Then bags were unfolded at the upper parts for cropping. Water was sprayed for maintaining moisture up to the desired level in the form of fine mist with the help of a nozzle. The Trial was laid out in CRD design

The data concerning spawn running (mycelia growth) were recorded after complete colonization of substrate and pin head and fruit body formation were observed. At the end of cropping, total weight of the mushrooms was calculated per bag and was expressed in biological efficiency of mushroom. The appropriate statistical method was used for the analysis of data. LSD (Least significant different) test at 5 % probability was applied to compare the differences among the treatments (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Number of Days taken to Reach Mycelial Growth

The bag size (6x12″) took maximum time to complete mycelial growth in (44.2) days where as bag size (8x12″) took minimum time to complete mycelial growth in (30.0) days. Further results are confirmed by Khan *et al*. (1980), Singh (1981). The variation in the completion of mycelial growth was observed in different treatments due to variation in substrate depth in different sizes of polypropylene bags which ultimately affected the substrate temperature.

Number of Days taken to develop pin heads.

Data presented in Table 1 shows that bag size (7x14″) took maximum number (10.4) of days to reach pinhead initiation as compared to bag size (8x12″) which took minimum number of days 8.8 days. Pinhead initiation is associated with the growth of mycelium. Ramzan (1982) studies the cultivation of different species of *Pleurotus* on padday straw. He reported 22 days and 26 days for pinhead formation after spawning. Mycelial growth, bag size, moisture level, aeration all affect on the pinheads initiation (Flegg, 1959). Pinhead initiation takes 17-29 days (Khan et al; 2004). The total number of pinheads was the highest (48.8) in the bag size (8x12″) as compared to bag size (6x12″) which gave minimum number of pinheads (25.4). Cormican and Staunton (1991) observed that moisture contents greater than 70% reduced the yield. Huhnke and Sengbush (1967) reported 27°C as the best

Table 1. Mycelial growth, pinhead initiation, number of pinheads, number of mature fruit bodies, number of days to mature fruit bodies

Bag size	Mycelial growth	Pinhead initiation (Days)	No. of pinheads	No. of Mature fruit bodies	No. of days to mature fruit bodies
7x14″	43.60	10.4	33.6	15.4	35.4
6x12″	44.20	10	25.4	15.2	35.2
8x12″	30.00	8.8	48.8	8.4	28.6
9x14″	40.40	10	38.4	10.6	30.6

Mycelial Growth: LSD Value = 3.057 (Highly Significant)
Pinhead initiation: Non-significant
Number of pinheads: Non-significant
Number of mature fruit bodies: LSD Value = 1.72221920 (Highly Significant)
Number of days to mature fruit bodies: LSD Value = 2.183 (Highly Significant)

temperature for mycelial growth. Growth rate decreases rapidly above 28°C with death of the mycelium occurring at 32°C and over.

Number of Mature Mushrooms

Table 1 depicted that bag size (7x14″) gave maximum number of mature mushrooms (15.4) as compared with the bag size (8x12″) which gave minimum number of mature mushrooms (8.4). At biological maturity, the mushroom has already lost a great deal of its original weight as spores and it will continue to lose weight through the deterioration of mushroom (Chang and Quimio 1984).Oyster mushroom, he observed that strip opening, forming big holes, or half opening polypropylene bags result in higher yield and larger sporophores (Marimuthu, 1995)

Number of days to reach harvesting stage

Mushroom sown in bag size 8x12″ reached harvesting stages after 28.6 days as compared to bag size 7x14″ in which the mushroom took 35.4 days to reach harvesting stage. Tan (1981) studied cotton waste as a substrate for the cultivation of *Pleurotus ostreatus.* Heltay (1987) studied the cultivation of *Pleurotus florida* on different substrates such as barley, rye and wheat bran. He observed that fruit bodies appeared in 49 days after spawning.

Total yield of Mushrooms

Different sizes of polypropylene bags showed significant effect on the total yield of the mushrooms (Table 2). The bag size 6x12″; gave maximum fresh weight 69.2gms as compared to bag size 8x12″ which gave minimum weight of 55gms. Manan (2000) studied the cultivation of oyster mushroom on cellulose material, (wheat straw) and observed highest yield of 198.67gm. Khan *et al.*, (2001) studied cotton waste recorded the highest yield of 198.67gm while wheat straw produce 129.2gm yield. Jadhav *et al.* (1996) studied the effects of different substrates on the yield of oyster mushroom. Cotton stalks and leaves gave the best results, with respect to sporophores number, weight of sporophores (5.12g) and total yield 914g/Kg of dry straw. The lowest yield (258g) was obtained on groundnut creeper. Zang *et al.* (1990) analyzed causes of low yield of oyster mushroom grown on wheat straw by studying three aspects i.e. substrate composition, water retention and quality. High yield could be achieved by adjusting the C/N ratio of substrate and water content by placing ring around the top of the culture bags to leave only 5cm diameter gap.

Table 2. Total yield of Mushroom (gms)

Bag Size	Yield (gms)
7x14″	68.6A
6x12″	69.2A
8x12″	55.0C
9x14″	65.4D

LSD Value = 3.0573709 (Highly significant)
Note: Any two means not sharing a letter in common differ significantly at 5% level of probability

Khanna and Garcha (1981) studied the cultivation of oyster mushroom on chopped paddy straw in fruit baskets during the period from December to March. The results revealed that accumulative yield of 32% of fresh mushroom were obtained in 105 days. The results of different spawning rates did not increase the yield significantly.

REFERENCE

Agrahar-Murugkar, D. and G. Subbulakshmi. 2005. Nutritional value of edible wild mushrooms collected from the Khasi hills of Meghalaya. Food Chemistry. 89, 599–603.

Anderson, E.E and C.R. Feller. 1942. The food value of mushroom *Agaricus compestris*. Pool. Am. Soc. Hort; 41:301-303.

Anonymous. 2000. Agricultural Statistics of Pakistan. Govt. of Pakistan, Food and agricultural Division (Planning Unit), Islamabad.

Chang, S.T and T.H. Quimio. 1984. Tropical mushrooms: biological nature and cultivation methods*. Chinese Uni. Hong Kong*.

Cheung, L.M. and P.C.K. Cheung. 2005. Mushroom extracts with antioxidant activity against lipid peroxidation. Food Chemistry. 89,403–409.

Cormican, T. and L. Staunton. 1991. Factors in mushroom compost Productivity. Mushroom Science. 8:221-224.

Flegg, P.B. 1959. The function of the compost and casing layer in relation to fruiting and growth of the cultivated mushroom *Psalliota Agaricus hortensis*. Mushroom Science. 4, 205-209.

Garcha, H.S., S. Dhanda and P. Khanna. 1985. Efficacy of container system for the production of *Pleurotus* Mushroom. Newsletter for the Tropics. 5(1):16.

Heltay, I. 1987. Production of oyster mushroom on large scale with modern techniques. P.H.M. Rev. Hort. 1977.

Huhnke, W. and R. von. Sengbusch. 1967. Die Beutung der Temperature bei der Kultur des Champignons insbesondere beim TILL-Verfahren. Die Gartenbauwis-senschaft, 32, 387-398.

Jadhav, A.B., P.K. Bagal and S.W. Jadhav. 1996. Effect of different substrates on the yield of Oyster mushroom .J. Maharashtra Agri. Uni; 21;3,424-426.

Justo, M.B., G.A. Guzma´n, E.G. Mejý´a, C.L.G. Dý´az, G. Martý´nez and E.B. Corona. 1998. Composition quý´ mica de tres cepas mexicanas de setas (*Pleurotus ostreatus*). Archivos Latinoamericanos de Nutricion. 48(4); 359–363.

Khan, A.M., S.M. Khan and S.M. Khan. 2001. Studies on the cultivation of Oyster mushroom (*Pleurotus ostreatus*) on different substrates.Pak.J.13 (2): 140-143.

Khan, N.A., S.M. Khan and M. Ashraf. 2004. Bio-Conversion of rice husk into *Pleurotus ostreatus.*Pak.J.16 (1): 9-12.

Khanna, P. and H.S. Garcha. 1981. Nutritive value of mushroom *Pleurotus florida.* Mush. Sci. 11 (1): 561-572.

Manan, A.R. 2000. Cultivation of Oyster mushroom on paper waste. M.Sc. Thesis, Dept. of Path. Uni. Agri. Faisalabad.

Manzi, P., L. Gambelli, S. Marconi, V. Vivanti and L. Pizzoferrato. 1999. Nutrients in edible mushrooms: an inter-species comparative study. Food Chemistry, 65(4), 477–482.

Marimuthu, T. 1995. Prospects of Oyster mushroom cultivation in Tamil Nadu. J. of Ecobiology. 7 (1): 27-34.

Quimio, T.H. 1986. Cultivation *Ganoderma* the "*Pleurotus* way". Mushroom. Newsletter for Tropics, The Chinese University of Hong Kong. 6(4) : 120-130.

Ramzan, M., 1982. Studies on the cultivation of Oyster mushroom (*Pleurotus spp.)* at Faisalabad. M.Sc. Thesis, Deptt. of Plant Pathology, Univ. of Agri., Faisalabad.

Shetty, K.S. and V. Krishanamoorthy. 1980. Possibility of protein enrichment of paddy straw by mushroom P. Sajor-caju (Proc. RRAI Symp.) PAU Ludhiana Ind., : 363-367.

Singh, R.P. 1981. Cultivation of *Pleurotus sajor-caju* (Fr.) Mush. Sci., 11(1): 667-73.

Steel, R.G.D. and J.H. Torrie. 1984. Principles and procedure of statistics. McGraw Hill Book International Co; Singapore. pp.172-177.

Tan, K.K. 1981. Cotton waste is a good substrate for cultivation of the Oyster Mushroom (*Pleurotus ostreatus)*. Mush. Sci., 11(1): 705-710.

Tewari, R.P. 1986. Mushroom cultivation. Extension Bulletin. Indian Institute of Horticulture Research, Banglore, India, 8:36.

Zhang, X.Y., G.P. Kim and B.L. OH. 1990. *Pleurotus ostreatus* spawn QPLO XI, Edible fungi of China. No. 6: 14-15.