EFFECT OF DIFFERENT MEDIA AND SPAWN RATE ON GROWTH AND YIELD OF OYSTER MUSHROOM

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EFFECT OF DIFFERENT MEDIA AND SPAWN RATE ON GROWTH AND YIELD OF OYSTER MUSHROOM

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CERTIFICATE

This is to certify that the thesis entitled, **"*Effect of different media and spawn rate on growth and yield of oyster mushroom*"** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in the partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (MS) in HORTICULTURE,** embodies the result of a piece of *bona fide* research work carried out by ***Nur-a-kawsar*,** Registration No. ***08-02713*** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed during the course of this investigation has been duly acknowledged and style of this thesis have been approved and recommended for submission.

Dated- June, 2015
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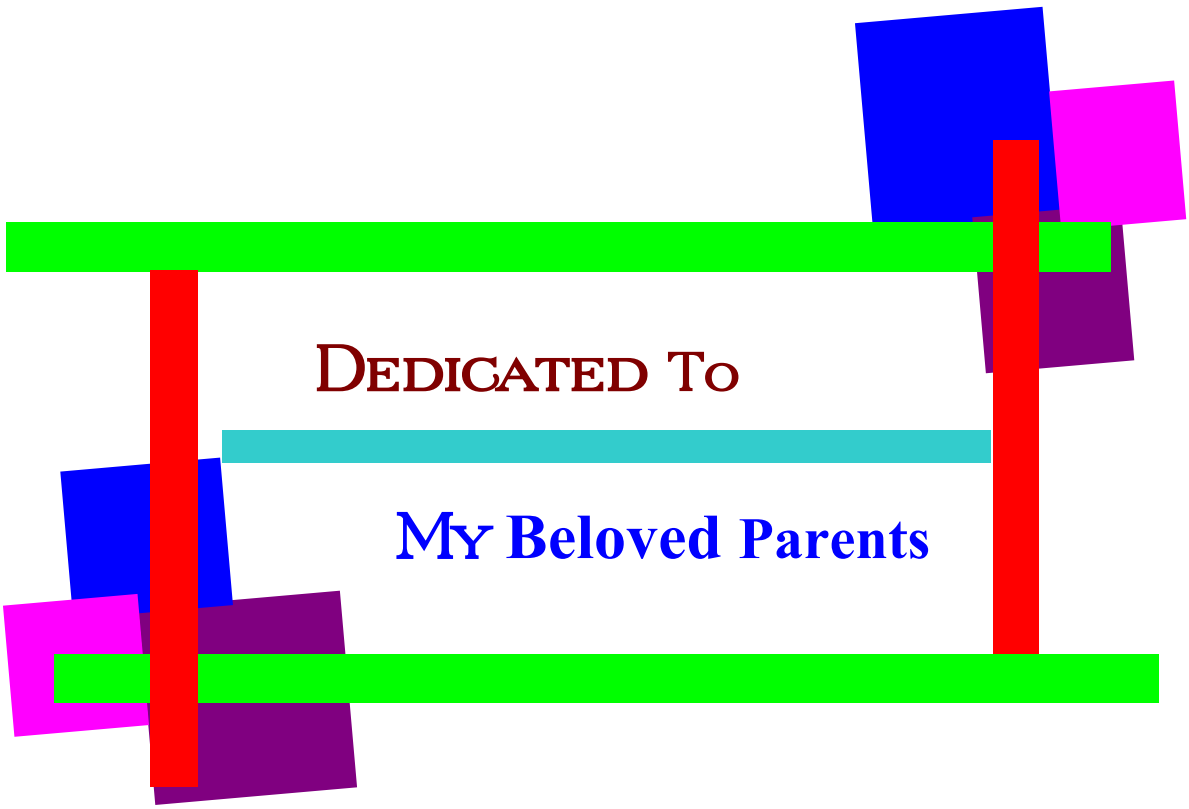
Dedicated To
My Beloved Parents

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ABSTRACT

The experiment was conducted at the Mushroom Development Institute, Shabhanbag, Savar, Dhaka during January to July, 2014. The experiment consists of two factors viz.: factor A: different media; M_1 = Paddy, M_2 = Millet and M_3 = Wheat and factor B: spawn rate; S_1 = 1:1 ratio (Media : Sawdust), S_2 = 2: 1 ratio (Media : Sawdust), S_3 = 3: 1 ratio (Media : Sawdust) and S_4 = 4: 1 ratio (Media : Sawdust). The experiment was laid out in two factors Completely Randomized Design with three replications. In case of different media, the highest mycelium running rate (0.76 cm), number of fruiting per packet (70.54), number of effective fruiting body per packet (62.61), single weight of fruiting body (5.06 g), biological yield (241.50 g), economic yield (227.00 g) and dry yield (21.83 g) was observed from M_1 treatment. In case of spawn rate, the highest mycelium running rate (0.77 cm), number of fruiting body (71.08), number of effective fruiting body (64.27), single weight of fruiting body (4.94 g), biological yield (231.40 g), economic yield (217.40 g) and dry yield (20.50 g) was recorded from S_4 treatment. In case of combined effect, the mycelium running rate (0.83 cm), number of fruiting body (75.63), number of effective fruiting body (71.38), single weight of fruiting body (5.61 g), biological yield (255.90 g), economic yield (241.30 g) and dry yield (25.10 g) was recorded from M_1S_4. Among the treatments paddy media with mixed 4:1 ratio paddy and sawdust was found suitable for growth and yield of oyster mushroom.

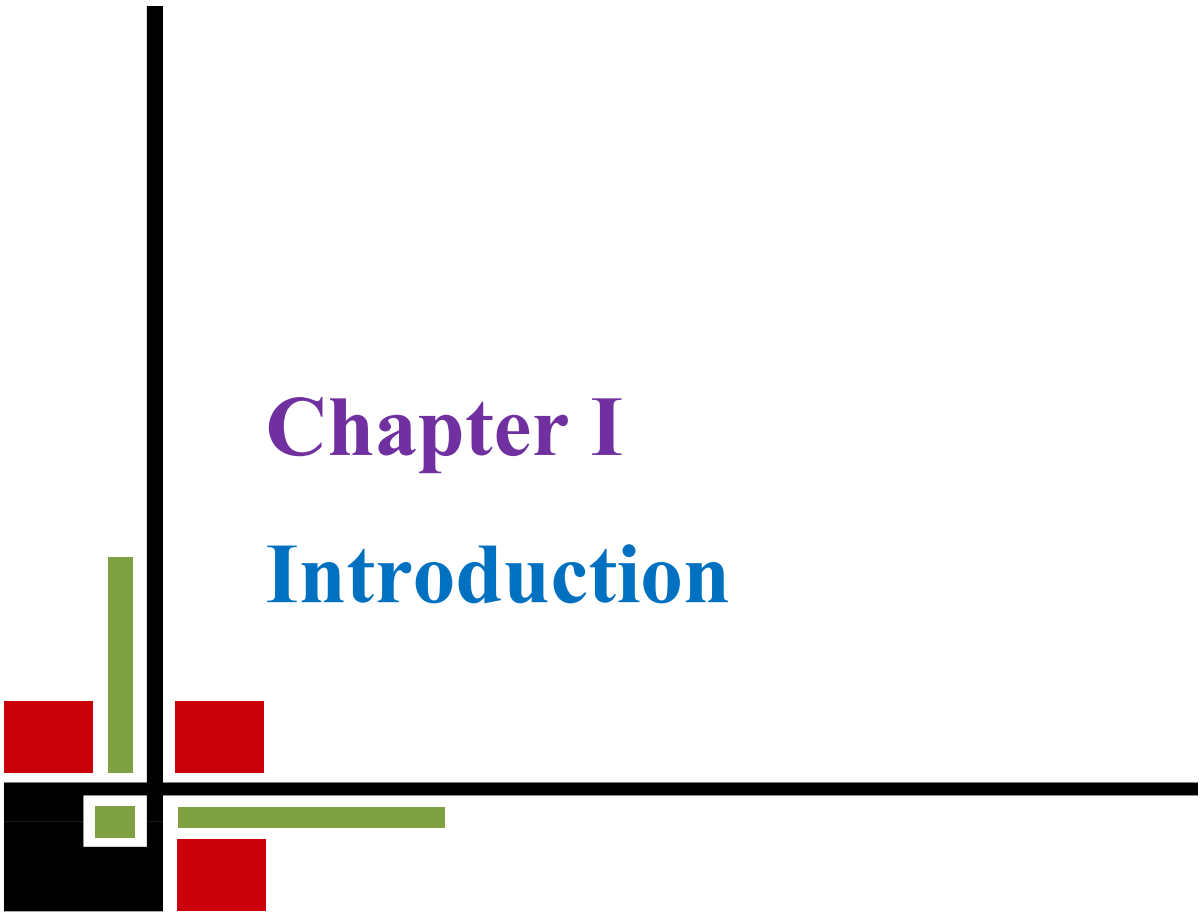
TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF APPENDICES

LIST OF PLATE



Chapter I

Introduction

CHAPTER I

INTRODUCTION

Mushroom is a highly nutritious, delicious, medicinal and economically potential vegetable. Mushrooms have been considered as a special kind of food since the earliest time. The Greeks believed that mushrooms provided strength for warriors in battle. The Pharoaphs prized mushrooms as a delicacy and the Romans regarded mushrooms as the "Food of the Gods," which was served only on festive occasions. The Chinese treasured mushrooms as a health food, the "Elixir of life." The Mexican Indians used mushrooms as hallucinogens in religious ceremonies and in witchcraft as well as for therapeutic purposes (Chang and Miles, 1988).

The low calorie and cholesterol free mushroom diets also display certain medicinal properties. Mushroom reduces the diabetic on regular feeding (Anderson and Ward, 1979). It also reduces the serum cholesterol in human bodies which reduces hypertension (Suzuki and Oshima, 1979). Mushroom inhibits the growth of tumor and cancer (Mori, 1986). Edible mushrooms have been treated as important tool in modern medicine for their medicinal values (Kovfeen, 2004). Oyster mushroom contains 19-35% protein on dry weight basis as compared to 7.3% in rice, 13.2% in wheat and 25.2% in milk (Chang and Miles, 1988). It contains 4.0% fat having good quantity of unsaturated fatty acids which are essential in our diet (Holman, 1976). It is rich in essential minerals and trace elements (Chandha and Sharma 1995). Mushrooms are source of Niacin (0.3 g) and Riboflavin (0.4 mg). Mushroom is a good source of trypsin enzyme. It is also rich in iron, copper, calcium, potassium, vitamin D and folic acid. Mushrooms are valuable health food, which are low in calories, high in vegetable proteins, zinc, chitin, fiber, vitamins and minerals (Alam and Saboohi, 2001). Mushroom reduces serum cholesterol and high blood pressure (Mori, 1986).

Bangladesh is a developing country and our agricultural land is decreasing day by day due to accommodation of large population. So, we have to increase intensive use of land for increasing crop production also considering natural hazards and other calamities. In this case mushroom cultivation can be a huge opportunity for increasing crop production per unit area with the vertical use of land. As a vegetable, Mushroom can play an important role to meet up the nutritional requirements of the population of our country. With increasing population and conventional agricultural methods we cannot cope with the food problem. Once, our staple food was rice and fish. At that time we could meet our protein need from fish as well as energy from rice. In the last decades the fish production decreased and we had to meet our protein need from vegetable source i.e. pulse. But now a days this is also much expensive and now we should find out an alternative source of protein as well as other food materials. Mushroom can help us in this aspect.

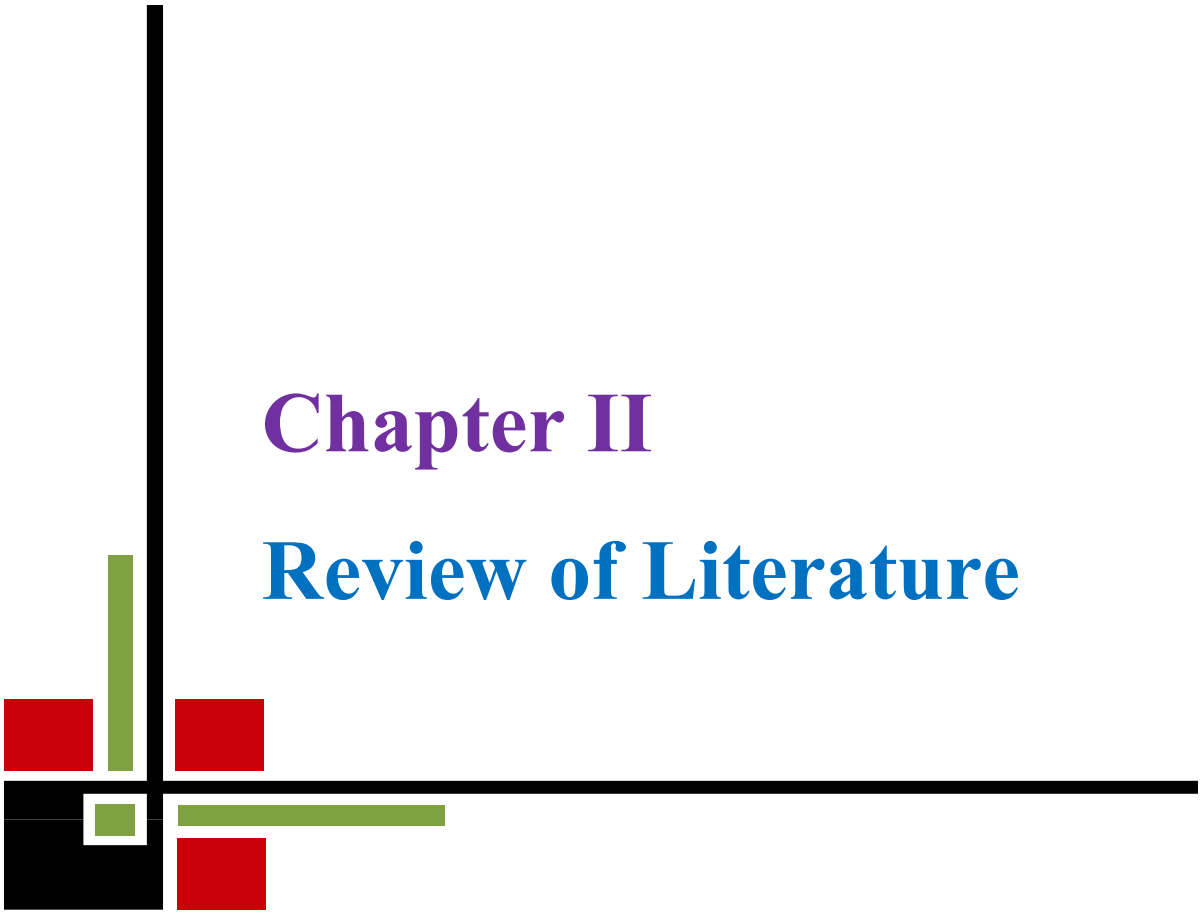
Media and spawn rate plays an important role in the yield and nutrient content of oyster mushroom. The media on which mushroom spawn (Merely vegetative seed materials) is grown, affects the mushroom production (Klingman, 1950). Sarker *et al*. (2007) observed a remarkable variation in nutritional content of oyster mushroom in different media. Oyster mushroom can grow on wheat and paddy straw, banana leaves, sugarcane bagasse and leaves, wheat barn, rice husk, sawdust etc. and their culture can be concentrated within a relatively small space.

The quality of the waste product (rice straw) is improved due to the degradation of cellulose and hemicellulose by mushroom enzymes and hence has been rendered more digestible. Thus rice straw is transformed to a valuable roughage and mushrooms provide an additional income without an extension of the limited acreage. (Amin *et al.*, 2007). Comparing rice straw with wheat straw, rice straw yielded about 10% more mushroom than wheat straw under the same cultivation conditions (Nuruddin *et al.,* 2010). Mushroom substrate may be defined as a kind of lingo cellulose material which supports the growth, development and fruiting of mushroom (Chang and Miles, 1988). Oyster mushroom may be grown on

wide range of plant waste as substrate e.g. sawdust, paddy straw, sugarcane baggage, corn stalk, corn cobs, waste cotton, leaves and pseudo stem of banana, water hyacinth, duck weed, rice straw etc. does not require costly processing method and enrichment material (Chang *et al.*, 1981; Upamanya and rathaiah, 2000 and Raghuramulu *et al.,* 2003).

If we use different media and different spawn rate on growth and yield performance may be achieved. So the investigation was undertaken to fulfill the following objectives:

- To increase the growth and yield of oyster mushroom.
- To prepare suitable media of oyster mushroom.
- To standardize appropriate spawn rate of oyster mushroom.
- To find out the interaction effect of different media based spawn packets.



Chapter II

Review of Literature

CHAPTER II

REVIEW OF LITERATURE

Mushrooms have been considered as a special kind of food since the earliest time. It grows well in waste materials. There are many scientific reports on the effect of different media and spawn rate on mushroom cultivation still there are major scope to investigate the effects of different media and spawn rate on oyster species. The review includes reports of several investigators which appear pertinent in understanding the problem and which may lead to the explanation and interpretation of results of the present investigation.

2.1 Effect of different media on growth and yield of oyster mushroom

Ramesh and Ansari (1987) evaluated several locally available substrates such as rice straw, banana leaves, saw dust, oil palm refuse, oil palm bunch refuse or grass straw in Andamans to study conversion efficiency of *Pleurotus sajor-caju*.

Suprapti (1987) measured the mushroom yield and harvesting frequency after cultivation on rubber wood (*Hevea brasiliensis*) sawdust mixed with 5, 10, 15 or 20 %, of leaves of either turi (*Sesbania grandiflora*) or lamtoro gung (*Leucaena leucocephala*). Average total yield per treatment was 643.00 g (532.29-744.69) per kg dry wt. of substrate. Addition of 40% lucerne hay (w/w) or 20% rapeseed meal (w/w) to the barley or wheat straw substrate gave the highest yields (275-300 kg/substrate) of *Pleurotus ostreatus*.

Patil (1989) cultivated *P. sajor-caju* on six different substrates, i.e. wheat straw, bajra (*Pennisetunz americana*), maize straw, paddy straw, jower and cotton stick. The results indicated that all the substrates could be used for commercial cultivation of the oyster mushroom.

Qin (1989) conducted an experiment to evaluate the performance of five species of *Pleurotus* grown on cotton seed hulls, wheat, rice and maize straw. The crude

protein content of the fruiting bodies was varied with different substrates. *Pleurotus sajor-caju* contained 41.26 % crude protein when cultivated on rice straw and 29 % when cultivated on wheat straw.

Thangamuthu (1990) in an investigation used sugarcane bagasse for growing *Pleurotus spp*. The two species gave similar yields at 500 g substrate, reaching maximum of 506-508 g on pretreated bagasse, 407-411 g on paddy straw and 379-391 g on wheat straw alone.

Khan *et al.* (1991) used sawdust to prepare compost for spawn running amended with lime and different combinations of wheat chaff, wheat bran, paddy straw and cotton waste. Sawdust from *D. sisso* was the most suitable for spawn preparation and all types of sawdust amended with cotton waste were found to give optimum conditions for spawn running

Royse *et al.* (1991) found that yields of *Pleurotus sajor-caju* strain 537 from the substrate supplemented with the commercial nutrient were 1.7-fold higher than yields from non-supplemented substrate. As the supplement level increased from 6 to 12 %, the mushroom yields increased. The yields ranged from 3.56 kg/m^2 for non-supplemented substrates to 7.36 kg/m^2 for substrate supplemented (12% DW) with formaldehyde soybean meal.

Ijaz and Khan (1992) reported that mushroom has been recently introduced in Pakistan. Different species/strains i.e. *Pleurotus sajor-caju*., *P. ostreatus* strain XI, *P. ostreatus* strain 467 and *P. ostreatus* were cultivated on cotton waste. *P. ostreatus* strain XI gave higher (260 g) basidiocarps out of 750 g of substrates per flush. It had 104 percent biological efficiency and 49 percent sustenance potential. In the same manner cotton waste scored maximum yield, biological efficiency and sustenance potential by defeating paddy straw + 25 percent synthetic compost, paddy straw and wheat straw in descending order.

Badshah *et al.* (1994) mentioned that *Pleurotus ostreatus* and *P. florida* were grown on wheat straw, sugarcane bagasse, corn cobs or sawdust and fruiting bodies were harvested at maturity. *P. ostreatus* and *P. florida* yields ranged from

49.8 and 277.7 g/2 kg substrate respectively on sawdust, to 432.8 and 420.5 g/ 2 kg substrate respectively, on wheat straw. Controls (grown in the field) yielded only 18.5 and 28.5 g/2 kg substrate for *P. ostreatus* and *P, florida*, respectively. In both species, wheat straw and sugarcane bagasse substrates resulted in the highest mushroom ascorbic acid contents and protein, fat and fiber contents were also affected by substrate. *Pleurotus florida* had higher fat but lower protein contents than *P. ostreatus*.

Marimuthu *et al.* (1994) investigate *Pleurotus sajor-caju*, *pleurotus citrinopileatus* and *pleurotus platypus* on paddy straw were tested for their response to substrate amendment with neem cake, rice bran, wheat bran and tapioca thippi (Factory waste). Neem cake at 5% level increased the yield of *P. citrinopileatus, P. sajor-caju* and *P. pathypus* by 26-49, 24-79 and 16% respectively and reduced the number of days required for completion of spawn run by 2-6, 5 and 6 days, respectively compared with control.

Murugesan *et al.* (1995) cultivated mushroom *Pleurotus sajor-caju* (Fr.) Sing, on water hyacinth (*Elchhorni crassipe*). They compared water hyacinth with other conventional substrates paddy straw. Total yields for 20 bags of the two substrates were 15.0 and 10.5 kg respectively, although the time taken to reach the pin-head stage was longer on the water hyacinth substrate (17 days in water hyacinth and 10 days in paddy straw). The high yield on water hyacinth was attributed to the C: N ratio (24.3 compared with 53.5) and low lignin content (9% compared with 17%) of this substrate. Use of water hyacinth would provide a cheap substrate and a means of eradicating a troublesome aquatic weed.

Mathew *et al.* (1996) investigated that *Pleurotus sajor-caju*, *Pleurotus* citrinopileatus, *Pleurotus florida*, *Pleurotus platypus* and *Pleurotus ostreatus* were evaluated for their yield performance on various substrates, both for spawn production and cultivation, in the plains and in the high ranges of Kerala in studies conducted in the summer and rainy seasons. Sorghum, wheat and paddy grains were equally good for spawn production. *Pleurotus sajor-caju*, *Pleurotus citrinopileatus* and *Pleurotus florida* were the most suitable species for

cultivation in both the plains and the high ranges. These 3 species were successfully cultivated on paddy straw, *Eliocharis plantogena* [*Eleocharis plantaginea*] and rubber wood [Hevea] sawdust, although for commercial cultivation of *Pleurotus sajor-caju*, rubber wood sawdust was not rated as an ideal medium.

Patrabansh and Madan (1997) used three different kinds of biomass, namely *Pofulus deltoides*, *Isuhatoriiun adenophorum* and sericulture waste individually for the cultivation of *Pleurotus sajor-caju*, alone and mixed with paddy straw. *P. sajor-caju*, when used alone, exhibited a very good colonizing ability on these substrates except in sericulture waste.

Chowdhury *et al.* (1998) examined the effects of adding rice husks, soybean meal, pea meal, wheat bran, poultry manure or neem cake (each at 2 or 5%) to rice straw for growing oyster mushrooms (*P. sajor-caju*). Adding 5% soybean or pea meal gave the highest yield of 630 g/kg dry straw.

Zhang-Ruihong *et al.* (1998) cultivated oyster mushroom (*P. sajor-caju*) on rice and wheat straw without nutrient supplementation. The effects of straw size reduction methods and particle sizes spawn inoculation level and types of substrate (rice straw vs. wheat straw) on mushroom yield, biological efficiency and substrate degradation were determined. The protein content of mushrooms produced was 27.2% on an average. The dry matter loss of the substrate after mushroom growth varied from 30.1 to 44.3%. Yields were higher from substrates which had been ground-up to 2.5 cm lengths; further size reductions lowered yields. Mushroom cultivation is a highly efficient method for disposing of agricultural residues as well as producing nutritious human food.

Patil and Jadhav (1999) reported that *Pleurotus sajor-caju* was cultivated on cotton, wheat, paddy, sorghum and soyabean straws in Marathwada, India. Cotton stalks + leaves was the best substrate for production (yield of 1039 g/kg dry straw), followed by soyabean straw (1019 g/kg). Paddy and wheat straw yielded 650 and 701g/kg. The lowest yield (475 g/kg) was obtained on sorghum

straw. Pileus size and stipe length of *P. sajor-caju* were greatest on sorghum straw.

Rathaiah and Shill (1999) in their experiment found that parboiled paddy was as good as wheat for spawn production of oyster mushroom. The spawn prepared from parboiled paddy was also compared with conventionally prepared paddy spawn. The suitability of parboiled paddy for spawn of paddy straw mushroom (*Volvariella volvacea*) was also confirmed.

Khan *et al.* (2001) investigated the different aspects of the cultivation of Oyster mushroom on industrial wastes to push it as a new biotechnology and as a commercial crop in Pakistan. They found that after spawn running, pinhead formation took 7-8 days and sporocarps formed after 10-12 days. Cotton waste recorded the highest yield of 198.67 g. Wheat straw yielded 129.253 g, paper waste + wheat straw yielded 58.95 g and paper waste alone recorded no yield. The best mycelium growth was observed in cotton waste substrate. The average time taken for complete spawn running was 17 days. The second best mycelium growth was on wheat straw, where the average time for spawn running was 19 days. In paper waste, the average time for spawn running was 22 days. However, the average time taken for completion of spawn running on paper waste + wheat straw was 20 days. The differences among the phase of mycelium growth and their interaction with substrate were statistically significant.

Dhoke *et al.* (2001) studied the effect of different agro-wastes on cropping period and yield of *Pleurotus sajor-caju* the experiments carried out in Prabhani and Maharashtra in India, during 1998-99. Various plant materials, i.e. soybean, paddy, cotton, wheat and jowar (*Sorghum bicolor*) were used. Cropping period on different substrates was recorded for first, second and third picking. The cropping period for third picking varied from 42.25 to 43.50 days in different substrates. The days required for first picking indicated that soybean straw took 22.00 days to produce first crop of harvestable mushroom while a minimum of 21.25 days were required for paddy and wheat straw. For second picking, jowar

and cotton waste took the maximum days of 32.75 days while soybean took the minimum of 31.50days. The final and third picking was completed in 43.50 days in case of soybean straw which was statistically higher compared to paddy and wheat straw (42.25) and cotton and jowar straw (42.75). The highest yield of 993.00 g/kg was obtained from cotton, followed by soybean straw (935.25 g/kg) and paddy straw (816.0 g/kg). The lowest yield of 445.50 g/kg was recorded in jowar straw.

Manzi *et al.* (2001) analyzed fresh and processed mushrooms (*Agaricus bisporus*, *Pleurotus ostreatus* and Boletus group). Results showed that botanical variety, processing and cooking are all effective determinants of mushroom proximate composition. Dried mushrooms (Boletus group) after cooking show the highest nutritional value, essentially due to insufficient dehydration. Dietary fiber, chitin and beta glucans, all functional constituents of mushrooms are present in variable amounts. Chitin level ranges from 0.3 to 3.9 g/100 g, while beta glucans which are negligible in *Agaricus*, range from 139 to 666 mg/100 g in *Pleurotus ostreatus* and Boletus group. On an average, a serving (100 g) of mushroom will supply 9 to 40% of the recommended of dietary fiber.

Shen and Royse (2001) evaluated the effects of various, combinations of wheat bran, rye and millet (At 20% and 30% of total dry substrate Wt) on crop cycle time, biological efficiency (BE) and mushroom quality for a commercially used isolate of *Grifola frondoso* (maitake). Supplements were combined with a basal ingredient of mixed oak (primarily red oak) sawdust and the resulting mixture was pasteurized, cooled, inoculated and bagged with an autoclaving mixer. Times to mushroom primordial formation and mushroom harvest were recorded, and mushroom quality was rated on a scale of 1-4, where 1 was the highest quality and 4 was the lowest quality. The combinations of 10%, wheat bran, 10% millet and 10% rye (BE 47.1%, quality 1.5 and crop cycle 12 weeks) and 10% wheat bran plus 20% rye (BE 44%, quality 1.7 and crop cycle 10 weeks) gave the most consistent yields and best basidiome quality over time.

Obodai *et al.* (2003) evaluated eight lignocellulosic by-products as substrate, for cultivation of the oyster mushroom. *Pleurotus ostreatus* (Jacq. ex. fr.) Kummer. The yields of mushroom on different Substrates were 183.1, 151.8, 111.5, 87.5, 49.5, 23.3, 13.0 and 0.0 g for composted Sawdust of *Triplochiton scleroxylon*, Rice straw, Banana leaves, Maize stover, Corn husk, Rice husk, Fresh Sawdust and Elephant grass respectively. The biological efficiency (BE) followed the same pattern and ranged from 61.0%, for composted Sawdust to 50.0% for elephant grass. Based on the yield and BE of the substrates tested, Rice straw appeared to be the best alternate substrate for growing oyster mushroom.

Amin (2004) in his experiment revealed that the highest number of primordia of oyster mushroom was found in sterilized paddy straw at first flush; whereas the lowest was obtained with saw dust.

Moni *et al*. (2004) cultivated the oyster mushroom (*Pleurotus sajor-caju*) on paddy straw, banana leaves, sugarcane baggase, water hyacinth and beetle nut husk. The fruit bodies were sun-dried and analyzed for various nutritional parameters. Considerable variation in the composition of fruit bodies grown on different substrates was observed. Moisture content varied from 88.15 to 91.64%. On dry matter basis, the percentage of nitrogen and crude protein varied from 4.22 to 5.59 and 18.46 to 27.78%, respectively and carbohydrate from 40.54 to 47.68%. The variation in content of crude fat and crude fiber ranged from 1.49 to 1.90 and 11.72 to 14.49% respectively whereas, energy value of fruit bodies was between 310.00 and KCal/100 g of fruit body weight.

Habib (2005) tested different substrates such as sawdust, sugarcane bagasse, rice straw, wheat straw and waste paper for the production of oyster mushroom in polypropylene bag. Different substrates significantly affected the number of primordia, number of fruiting bodies and amount of fresh weight or yield. This experiment revealed that the highest number of primordia and fruiting bodies were found in waste paper 43.75 and 31.00 respectively. The highest amount of fresh weight was also found in waste paper 94.25 g.

Namdev *et al.* (2006) conducted a study to determine the effect of different straw substrates on spawn growth and yield of oyster mushroom. The number of days required for spawn run was significantly less (14 days) in case of gram straw, parthenium straw, sugarcane straw and wheat straw, compared with 20 days for sunflower stalk, mustard straw and paddy straw. Yield was very poor on parthenium straw (95 g/500 g dry substrates) and it was highest on paddy straw (666 g/500 g), followed by wheat straw and mustard straw (427 and 400 g/500 g respectively).

Zape *et al*. (2006) conducted a study to determine the spawn run, days taken to pin head initiation, yield and biological efficiency of three oyster mushroom species viz. *Pleurotus florida, P. eous* and *P. flabellatus* were grown on wheat straw substrate. Time required for spawn run and pinning was significantly less in *Pleurotus eous* followed by *P. florida*. However, the yield and biological efficiency did not differ significantly but was higher in *P. florida* than *P. flabellatus* and *P. eous*. In analyzing the physico-chemical composition of dehydrated fruit bodies of *Pleurotus* species revealed that among different species *P. eous* was rich in protein (33.89%), moderate in fat (3.10%), carbohydrate (32.60%) and ash (8%) followed by *P. florida*. However, *P. flabellatus* was rich in crude fibre, carbohydrate and ash but low in protein and fat content as compare to *P. eous* and *P. florida.*

Sarker *et al*. (2007) carried out an experiment to find out the performance of different cheap agricultural household byproducts, grasses and weeds as substrate available in Bangladesh. The minimum duration to complete mycelium running was 17.75 days in waste paper, which differed significantly from that in all other substrates. Significant variation was found in duration from stimulation to primordial initiation, primordial initiation to first harvest and stimulation to first harvest in different substrates. The minimum duration required from stimulation to first harvest was observed in sugarcane bagasse (6.75 days), which was statistically identical to that in waste paper, wheat straw and sawdust (7.00 days). The number of fruiting body was positively correlated with biological

efficiency, biological yield and economic yield of oyster mushroom. The number of fruiting body grown on different substrates differed significantly and the highest number of fruiting body per packet (183.25) was recorded on waste paper, which was significantly higher as compared to all other substrates. The lowest number of fruiting body (19.25) was observed in water hyacinth. Significant variation in biological efficiency, biological yield and economic yield of oyster mushroom were observed in different substrates. The highest economic yield (225.43 g/packet) was estimated from the waste paper followed by wheat straw (215.72 g/packet).The economic yield on sugarcane bagasse was 191.98g/packet, which was statistically identical to that grown on rice straw (183.28 g/packet), kash (182.93 g/packet) and ulu (175.15g/packet).The economic yield on sawdust was 160.40g/packet, which was statistically identical to that on ulu. The lowest economic yield was observed in water hyacinth (33.59g/packet). No fruiting body and economic yield were obtained from para and nepier grasses. Performances of the substrates were compared based on benefit cost ratio (BCR). The highest BCR (6.50) was estimated when wheat straw was used as substrate followed by sugarcane bagasse (5.90), waste paper (5.65), rice straw (5.58) and kash (5.25) The lowest BCR was obtained from water hyacinth (1.05) followed by ulu (4.74) and sawdust (4.90).

Sangeetha (2007) carried out an experiment to study the effect of organic amendments on yield performance of pink mushroom. The organic amendments viz., groundnut cake powder, neem cake powder, rice bran and black gram powder were added at 3 and 5% levels to mushroom beds as amendments during cultivation. Neem cake at 5% level significantly increased the sporophore production (690.1 g) followed by 3% level (675.3 g). These treatments produce fruiting bodies earlier (10.8 to 11 days) than other amendments tried (11.1 to 12 days). Except neem cake powder and rice bran, all the other amendments had little effect on increasing the yield.

Ali *et al.* (2010) conducted an experiment to investigate the performance of different levels of wheat bran (0, 10, 20, 30 and 40 %) as supplement with

sugarcane bagasse on the yield and proximate compositions of oyster mushroom were studied. The highest mycelium growth rate (0.96 cm/day), the highest average number of primordia/packet (70.67), average number of fruiting body/packet (61.00) were observed in sugarcane bagasse supplemented with 40% wheat bran. The lowest time from primordia initiation to harvest (3.23 days) and the highest average weight of individual fruiting body (3.69 g) were observed in 30% level of wheat bran. The highest biological yield (254.7 g / 500 g wet substrate), economic yield (243.3 g), dry matter (23.40 g), biological efficiency (87.82%) and benefit cost ratio (8.29) were also observed in 30% level of wheat bran. The highest content of protein (30.31 %), ash (9.15 %) and crude fiber (24.07 %) and the lowest content of lipid (3.90 %) and carbohydrate (32.57 %) were recorded in 30% wheat bran.

2.2 Effect of spawn rate on growth and yield of oyster mushroom

Ancona *et al.* (1995) reported that *C. odorata*, a common weed of the tropics, was examined as a potential substrate for cultivation of *Pleurotus flabellatus*. Performance was evaluated using *C. odorata*, dried or fresh and sterilized or not sterilized, as a sole substrate and in combination with paddy straw (1:1). The results indicate that *C. odorata* residues can be used for the commercial cultivation of *Pleurotus*.

Singh *et al.* (1995) reported that the *Pleurotus florida* was cultivated on wheat straw, paddy straw and sugarcane trash (dried leaves) used either separately or in 1:1 ratio, yield and biological efficiency were the highest in paddy straw. The effects of different forest wastes on the radial growth of *Lentinus edodes* Berk were studied. Three types of sawdust from Shishum (*Dalbergia sisso*) 'Kikar' (*Acacia arabica*) and Poplar (*Populus alba*) amended with wheat bran and lime were used for spawn preparation.

Jadhav *et al.* (1996) reported that oyster mushroom (*Pleurotus sajor-caju*) was cultivated on wheat straw, paddy straw, talks and leaves of maize or cotton,

jowar, soyabean straw, groundnut creepers plus wheat straw (1:1), soyabean straw plus groundnut creepers (1:1), or groundnut creepers alone. Cotton stalks and leaves gave the best results with respect to sporophore number, weight of sporophore (5.12 g) and total yield (914 g/kg of dry straw). Yields obtained on other substrates were: 796 g on paddy straw; 557 g on soyabean straw; and 508 g on soyabean + wheat straw. The lowest yield was recorded on groundnut creeper (258 g).

Biswas *et al.* (1997) reported that methods including spawning percentage, combinations of paddy straw, wheat straw and supplements, to improve the biological efficiency (BE) of *P. florida* were investigated in Madhya Pradesh, India. Increasing spawning rates reduced the time required for spawn runs. The highest BEs (66.8-101.25%) was observed after the use of the highest spawning percentages. A 1:1 mixture of paddy straw wheat straw promoted a high BE (106.5%); supplementation of this substrate with 5% rice flour also promoted BE (125.75%).

Kalita *et al.* (1997) studied the growth of *Pleurotus sajor-caju* in polyethylene bag on different combinations of substrates viz. only rice straw, rice straw plus rice husk mixture (1:1 v/v), water hyacinth, chopped banana leaves, areca nut husk and sugarcane bagasse. They found that only rice straw, rice straw plus rice husk mixture and areca nut husk substrates completed spawn running comparatively within short time (12-14 days) but other substrates took longer time.

Pani and Mohanty (1998) used water hyacinth alone and in combination with paddy straw (3:1, 1:1 and 1:3 ratios) for cultivation of *Pleurotus sajor-caju* and *P. Florida*. Paddy straw alone sustained highest mushroom yield (83.3-84.6% BE). Water hyacinth in combination with paddy straw produced higher yields than when used alone.

Lim *et al.* (1998) conducted that the feasibility of growthing oyster mushroom on dired aerial parts of Cassia hirsute in combination with different levels of

bagasse (100:0, 75:25, 50:50, 25:75 or 0:100) was examined. Equal amounts of these substrates (1:1 proportion) gave the highest yield (313 fruiting bodies) and the highest bio-efficiency 65-94%.

Ayyappan *et al.* (2000) used sugarcane trash and coir waste alone and in combination with paddy straw (3:1, 1:1 and 1:3 w/w) for sporophore production of two species of *Pleurotus*. The highest yields of *P. florida* (1395 g) and *P. citrinopileatus* (1365 g) were recorded in a mixture of sugarcane.

Baysal *et al.* (2003) conducted an experiment to spawn running, pin head and fruit body formation and mushroom yield of oyster mushroom (*Pleurotus ostreatus*) on waste paper supplemented with peat, chicken manure and rice husk (9:1; 8:2). The fastest spawn running (mycelia development) (15.8 days), pin head formation (21.4 days) and fruit body formation (25.6 days) and the highest yield (350.2 g) were realized with the substrate composed of 20% rice husk in weight. In general, increasing the ratio of rice husk within the substrate accelerated spawn running, pin head and fruit body formation and resulted increased mushroom yields, while more peat and chicken manure had a negative effect on growing.

Banik and Nandi (2004) carried out an experiment on oyster mushroom for its ease of cultivation, high yield potential as well as its high nutritional value. Laboratory experimentation followed by farm trial with a typical oyster mushroom *Pleurotus sajor- caju* revealed that the yield potential of these mushrooms can be increased significantly when grown on a lignocellulosic crop residue - rice straw supplemented with biogas residual slurry manure in 1:1 ratio as substrate. Residual slurry manures obtained from biogas plants utilising either cattle dung or poultry litter, jute caddis or municipal solid waste as substrates for biogas production were all effective in increasing the yield of *Pleurotus sajor-caju* significantly although to different extents. Disinfection of straw and manure by means of 0.1 % $KMnO_4$ plus 2 % formalin solution in hot water caused 42.6 % increase in yield of *Pleurotus sajor-caju* over control, i.e., when disinfection

done with hot water. In addition to increased yield, the above treatments caused significant increase in protein content, reduction in carbohydrate and increase in essential mineral nutrients in mushroom sporophores. Thus, it is concluded from the study that supplementation of rice straw with biogas residual slurry manure has strong impact in improving the yield potential, protein and mineral nutrient contents of *Pleurotus sajor caju* mushroom in Indian subcontinent or similar climatic conditions.

Shah *et al.* (2004) carried out an experiment to investigate the performance of Oyster mushroom on the following substrates: 50 % sawdust + 50 % wheat straw, 75 % sawdust + 25 % leaves, 50 % wheat straw + 50 % leaves, 100 % sawdust, 100 % wheat straw and 100 % leaves. The temperature was kept at 25 degrees C for spawn running and 17-20 degrees C for fruiting body formation. The time for the completion of mycelial growth, appearance of pinheads and maturation of fruiting bodies on different substrates were recorded. The number of fruiting bodies and the biological efficiency of substrates were observed. The results show that spawn running took 2-3 weeks after inoculation, while small pinhead-like structures formed 6-7 days after spawn running. The fruiting bodies appeared 3-6 weeks after pinhead formation and took 27-34 days later after spawn inoculation. Sawdust at 100 % produced the highest yield (646.9 g), biological efficiency (64.69 %) and the number of fruiting bodies (22.11). Therefore, sawdust is recommended as the best substrate for Oyster mushroom cultivation.

Khlood and Ahmad (2005) conducted an experiment to study the ability of oyster mushroom (*Pleurotus ostreatus*) P015 strain to grow on live cake mixed with wheat straw. The treatments comprised: 90% straw + 5% wheat bran + 5% gypsum (control); 80% straw + 10% olive cake + 5% wheat bran + 5% gypsum (T_1); 70% straw + 20% olive cake 5% wheat bran + 5% gypsum (T_2); 60% straw + 30% olive cake + 5% wheat bran + 5% gypsum (T_3); 50% straw + 40% olive cake + 5% wheat bran +.5% gypsum (T_4); and 90% olive cake + wheat bran + 5% gypsum (T_5). After inoculation and incubation, transparent plastic bags were

used for cultivation. The pinheads started to appear after 3 days and the basidiomata approached maturity 3-7 days after pinhead appearance. Several growth parameters including primordial induction and fructification period, earliness, average weight of individual basidiomata, average yield for each treatment, diameter of the pileus and biological efficiency percentage (BE%) were examined and proximate analyses for protein, crude fat, crude fiber, ash, carbohydrates, mineral and moisture contents were performed. The addition of 30% olive cake to the basal growing medium gave the highest yield (400 g/500 g dry substrate), average weight (21.5 g/cap) and average cap diameter (7.05 cm/cap) and BE% (80%). Carbohydrate, protein and fiber contents were high in the *P. ostreatus* basidiomete. Ash contents were moderate, while fat content was low. For mineral contents in the mushrooms the trend was the same in all treatments. The K and P contents were high compared to the other minerals in all treatments, sodium was moderate while both Mg and Ca were found at low concentrations (Mg was relatively higher than Ca). Fe and Zn were relatively high compared to Cu and Mn which had very low concentrations.

Amin *et al*. (2007) carried out an experiment to find out the primordia and fruiting body formation and yield of oyster mushroom (*Pleurotus ostreatus*) on paddy straw supplemented with wheat bran (WB) wheat flour (WF), maize powder (MP), rice bran (RB) and their three combination (WB+MP, 1:1), (WB+MP+RB, 1:1:1) and wheat broken (WBr) at six different levels namely 0,10,20,30,40 and 50% were studied. The minimum time (4.5 days) for primordial initiation was observed in the MP at 20% level and the highest number of effective fruiting bodies (60.75) was obtained in WF at 50% level. The highest biological yield (247.3 g/packet) was recorded at 10% level of (WBr).

Mondal *et al.* (2010) conducted that the experiment was carried out in the mushroom cultivation laboratory, Horticulture Center, Khairtala, Jessore to evaluate the better performance of oyster mushroom *Pleurotus florida* in different substrate compositions as well as to find out the better substrate for

mushroom cultivation. Highest mycelium running rate was found in banana leaves and rice straw (1:1) but the lowest in control. Completion of mycelium running time was lowest in banana leaves and rice straw (1:3 and 3:1). Number of total primordia and effective primordia, found highest in control but the maximum pileus thickness was measured from rice straw. Highest biological yield and economic yield (164.4 g and 151.1 g) was obtained from rice straw which was much higher than control. From the graphical view, both positive and negative relationships were found between economic yield and different yield contributing attributes.

Chapter III

Materials & Methods

CHAPTER III

MATERIALS AND METHODS

The study was conducted during the period from January to July 2014 to study effect of different media and spawn rate on the growth and yield of oyster mushroom. The chapter includes a brief description of the location of experimental site, soil and climate condition, materials used for the experiment, design of the experiment, preparation of substrates, preparation of packets, cultivation of spawn packet, collection of produced mushrooms, data collection and data analysis procedure. The details materials and methods are presented below under the following headings-

3.1 Experimental site

The experiment was conducted at the Laboratory and Culture house of Mushroom Development and Extension Programme, Mushroom Development Institute, Sobhanbang, Savar, Dhaka during January to July, 2014.

3.2 Planting materials

Mother culture of oyster mushroom was collected from Mushroom Development Institute (MDI), Savar, Dhaka.

3.3 Varietal characteristics of Pink Oyster Mushroom

Oyster mushroom is *Pleurotus djamor* var. *roseus* that has a light to dark pink colored cap depending the growing conditions. Primordia and young mushrooms are bright pink but become less intensely colored as the mushroom matures. Pink oyster mushroom is characterized by the rapidity of the mycelial growth and high saprophytic colonization activity on cellulosic substrates. Their fruiting bodies are shell or spatula shaped with pink color. If the temperature increases above

32^0C, its production markedly decreases. Oyster mushroom is quick growing and our country grow round in the year but suitable for summer season.

3.4 Treatment of the experiment

The experiment consists of two factors design with three replications.

Factor A: Different media

M_1 = Paddy,

M_2 = Millet and

M_3 = Wheat.

Factor B: Spawn rate

S_1 = 1:1 ratio (Media : Sawdust),

S_2 = 2: 1 ratio (Media : Sawdust),

S_3 = 3: 1 ratio (Media : Sawdust) and

S_4 = 4: 1 ratio (Media : Sawdust)

3.5 Design and layout of the experiment

The experiment was laid out in two factors Completely Randomized Design (CRD). The experiment included 12 (3 × 4) treatments with three replications and five spawn packets in each replication.

3.6 Preparation of spawn

3.6.1 Preparation of mother culture: Paddy

To prepare mother culture of the test mushroom (Oyster mushroom) paddy grains were used as media of mother culture. At first grains collected which was free from diseases and not broken, old and insect damage. The grains were through washed in sufficient water for 2-3 hours and boiled in a container for 25-45 minutes until slightly cracking. Excess water was remove by heat. When the water was removed from the grain then the burner was stopped. After 1-2 hours was the grain was cooled, then the master mother was poured or mixed at 10% rate of paddy grains (i.e., one master mother culture was needed for 2 kg of

grain). Then the polypropylene bags of 18 cm × 25 cm size were filled with plugged by inserting absorbent cotton without plastic neek and tited with a rubber band. Then the packets/bags were kept in a rack at room temperature. The substrate grain was covered by whitish mycelium within 10-12 days after spawning. The fully colonized packets were used as mother for spawn packets preparation.

3.6.2 Preparation of mother culture: Millet

To prepare mother culture of the test mushroom (Oyster mushroom) millet grains were used as media of mother culture. At first grains collected which was free from diseases and not broken, old and insect damage. The grains were through washed in sufficient water for 2-3 hours and boiled in a container for 25-45 minutes until slightly cracking. Excess water was remove by heat. When the water was removed from the grain then the burner was stopped. After 1-2 hours was the grain was cooled, then the master mother was poured or mixed at 10% rate of paddy grains (i.e., one master mother culture was needed for 2 kg of grain). Then the polypropylene bags of 18 cm × 25 cm size were filled with plugged by inserting absorbent cotton without plastic neek and tited with a rubber band. Then the packets/bags were kept in a rack at room temperature. The substrate grain was covered by whitish mycelium within 10-12 days after spawning. The fully colonized packets were used as mother for spawn packets preparation.

3.6.3 Preparation of mother culture: Wheat

To prepare mother culture of the test mushroom (Oyster mushroom) whea grains were used as media of mother culture. At first grains collected which was free from diseases and not broken, old and insect damage. The grains were through washed in sufficient water for 2-3 hours and boiled in a container for 25-45 minutes until slightly cracking. Excess water was remove by heat. When the water was removed from the grain then the burner was stopped. After 1-2 hours was the grain was cooled, then the master mother was poured or mixed at 10%

rate of paddy grains (i.e., one master mother culture was needed for 2 kg of grain). Then the polypropylene bags of 18 cm × 25 cm size were filled with plugged by inserting absorbent cotton without plastic neek and tited with a rubber band. Then the packets/bags were kept in a rack at room temperature. The substrate grain was covered by whitish mycelium within 10-12 days after spawning. The fully colonized packets were used as mother for spawn packets preparation.

3.6.4 Preparation of substrate

The sawdust was prepared by pasteurization method. 20 kg sawdust was mixed 17 liter of water then 10-12 kg mixed with poured into cribriform nylon bag. The bags were kept in a rack of pasteurization chamber out 60-65°C for one hour. There after the bags were kept in same place for 18-20 hours to get cool slimly. After about 20 hours the sawdust Was spread over polythene sheet in the open place to reduce the moisture level of 63%.

3.6.5 Preparation of spawn packet

The polypropylene bags of 18 cm ×25 cm size were filled with pasteurized sawdust and mother culture according to treatments. Pasteurized sawdust and paddy, millet and wheat grains containing mother mixed thoroughly without supplementation. The mixed substrates were filled in different spawn rate (1:1, 2:1, 3:1 and 4:1) @ 500 g. The filled polypropylene bags were prepared by using plastic neck and plugged the neck with cotton and covered with brown paper placing rubber band to hold it tightly in place. Thorough spawning of the substrate was also followed in which the spawn was thoroughly mixed with the wet substrate before bagging.

3.6.6 Cultivation of spawn packet

Two ends, opposite to each other of the upper position of plastic bag were cut in "D" shape with a blade and opened by removing the plastic sheet after which the opened surface of substrate was scraped slightly with a tea spoon for removing

the thin whitish mycelial layer. The packets of each type were placed separately on the rack of culture room. The moisture of the culture room was maintained 80-85% relative humidity by spraying water 3-5 times a day. The light around 80-200 lux and ventilation of culture house was maintained uniformly. The temperature of culture house was maintained 22^0C to 25^0C. The first primordia appeared 2-3 days.

3.6.7 Harvesting of mushrooms

Pink mushrooms matured within 3-5 days after primordia initiation. The matured fruiting body was identified by curial margin of the cap, as described by Amin (2002). Mushrooms were harvested by twisting to uproot from the base.

3.7 Data collection

3.7.1 Mycelium running rate in spawn packet

Mycelium running rate (MRR) for each type of substrate was measured after the mycelium colony cross the shoulder of the packet. The linear length was measured at different places of packet using the following formula (Sarker, 2004):

$$\text{MRR}= \frac{L}{N} \text{ cm/day}$$

Where, L= Average length of mycelium running (cm)

N= Number of days

3.7.2 Days to require from opening to primordial initiation

Days required from opening to primordial initiation were recorded.

3.7.3 Days to require from opening to harvest

Days required from opening to harvest were recorded.

3.7.4 Number of fruiting body per packet

Number of well-developed fruiting body was recorded. Dry and pinheaded fruiting bodies were discarded but tiny fruiting bodies were included in counting.

3.7.5 Weight of individual fruiting body per packet

Average weight of individual fruiting body was calculated by dividing the total weight of fruiting body per packet by the total number of fruiting body per packet.

3.7.6 Dimension of fruiting body (stipe and pileus)

Length of the pileus of three randomly selected fruiting bodies was measured using a slide calipers. Diameter of stipe, diameter and thickness of pileus were also measured.

a. Length of stipe (cm)
b. Diameter of stipe (cm)
c. Diameter of pileus (cm)
d. Thickness of pileus (cm)

3.7.7 Biological yield

Biological yield per 500 g packet was measured by weighing the whole cluster of fruiting body without removing the lower hard and dirty portion.

3.7.8 Economic yield

Economic yield per 500 g packet was recorded by weighing all the fruiting bodies in a packet after removing the lower hard and dirty portion.

3.7.9 Drying of mushrooms

The collected fruiting bodies of the mushroom were transferred to the laboratory. Then data were collected on different parameter. After collection of the data the

fruiting bodies were dried in the sun separately as per treatment. In the time of drying the stalk and the pileus were separated for better drying.

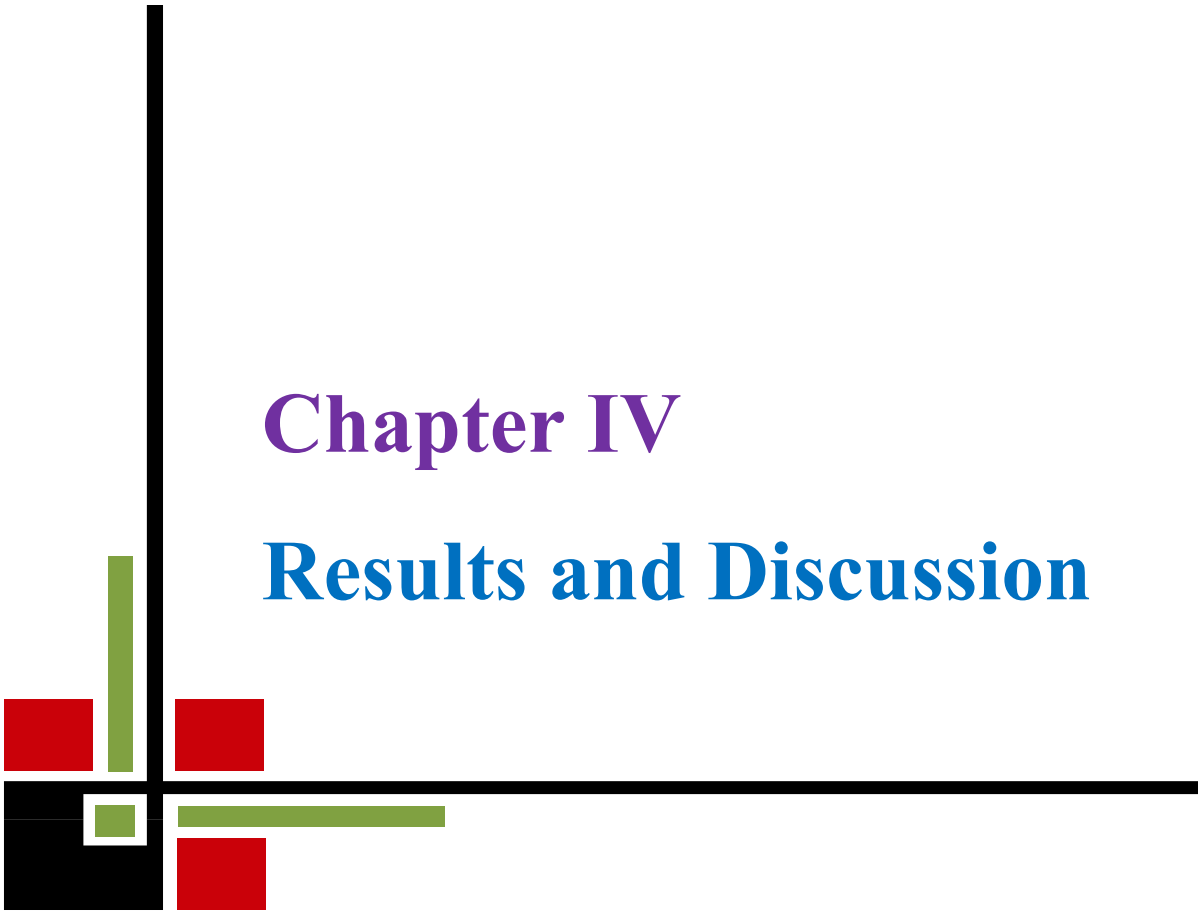
3.7.10 Dry yield

About 50 g of randomly selected mushroom sample was taken in a paper envelop and was weighed correctly. The mushroom was oven dried at 72^0C temperature for 24 hours and weighed again. The weight of blank envelop was subtracted from both the initial weight. The dry yield was calculated using the following formula (Sarker, 2004):

$$\text{Dry yield (g/500g packet)} = \text{Economic yield} \times \frac{\text{Oven dry weight of sample (g)}}{\text{Fresh weight of sample (g)}}$$

3.8 Statistical analysis

The data obtained for different parameters were statistically analyzed to find out the significance of the difference among the treatment. The mean values of all the characters were evaluated and analysis of variance was performing by the 'F' test. The significance of the difference among the treatments means was estimated by the least significant difference (LSD) test at 5% level of probability (Gomez and Gomez, 1984).



Chapter IV

Results and Discussion

CHAPTER IV

RESULTS AND DISCUSSION

The study was conducted to find out the effect of different media and spawn rate on the growth and yield of oyster mushroom. The results have been presented and discusses with the help of figure(s), table(s) and possible interpretations given under the following sub headings:

4.1 Mycelium running rate

Mycelium running rate of oyster mushroom showed statistically significant variation due to different media under the present trial (Figure 1). The highest mycelium running rate was recorded from M_1 (0.76 cm) (paddy media), followed by M_2 (0.70 cm) (millet media), while the lowest mycelium running rate was observed in M_3 (0.64 cm) (sawdust media). Different media showed different mycelium running because of different carbohydrate based on availability and the environment of the spawn. Mycelium running rate varied due to use of different media. Statistically highest mycelium running rate was observed in paddy media. The present findings found more or less similar with the previous workers. Khan *et al.* (1991) reported that different media with different organic supplement like wheat chaff, wheat bran, paddy straw, cotton waste etc. provided suitable condition for spawn running. Sarker (2004) found that the mycelium running rate of oyster mushroom greatly influenced with the supplement of paddy in different levels. Bhuyan (2008) also found similar trend of result as found in the present experiment.

Mycelium running rate of oyster mushroom showed statistically significant variation due to different spawn rate (Figure 2). The highest mycelium running rate was recorded from S_4 (0.77 cm) (4:1 ratio), followed by S_3 (0.72 cm) (3:1 ratio), while the lowest mycelium running rate was observed in S_2 (0.68 cm) (2:1 ratio), followed by S_1 (0.62 cm) (1:1 ratio).

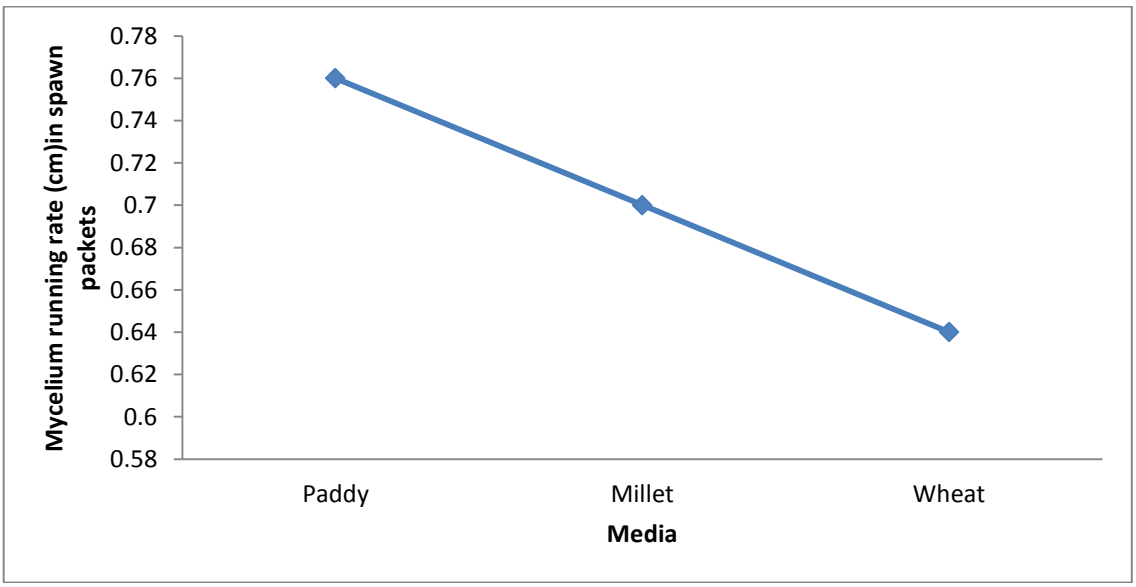


Figure 1. Effect of media on mycelium running rate(cm) per packet of oyster mushroom (LSD value =0.01)

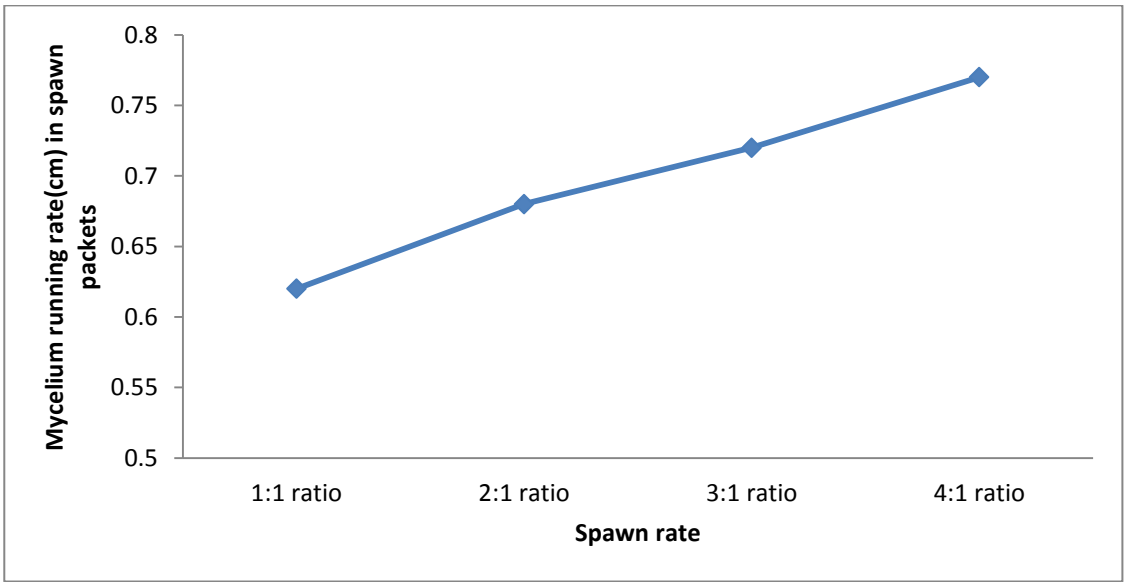


Figure 2. Effect of spawn rate on mycelium running rate(cm) per packet of oyster mushroom (LSD value = 0.02)

Significant combined effects of media and spawn rate on mycelium running rate of oyster mushroom was observed (Table 3). The highest mycelium running rate was recorded from M_1S_4 (0.83 cm) (paddy with 4:1 ratio). On the other hand, the lowest mycelium running rate was observed in M_3S_1 (0.52 cm) (wheat with 1:1 ratio).

4.2 Days required from opening to primordial initiation

There was significant variation in terms of days to require from opening to primordial initiation of oyster mushroom due to different media (Table 1). The maximum days to require from opening to primordial initiation was found from M_3 (8.20 days) (wheat media), followed by M_2 (7.95 days) (millet media), whereas the minimum was recorded in M_1 (7.12 days). The result of the present finding was found similar with Gupta (1989); Khan *et al.* (2001); Royse *et al.* (1991); Sarker (2004) and Amin *et al.* (2007). Sarker (2004) observed that duration from primordial initiation of oyster mushroom was significantly lower as rice straw or paddy. Amin *et al.* (2007) found significant differences on time from opening to primordial initiation. Bhuyan (2008) also found similar effect as found in the present study.

Days to require from opening to primordial initiation showed statistically significant variation due to spawn rate (Table 2). The maximum days to require from opening to primordial initiation was recorded from S_1 (8.43 days) (1:1 ratio), followed by S_2 (7.97 days) (2:1 ratio), while the minimum days to require from opening to primordial initiation was observed in S_4 (7.07 days) (4:1 ratio), followed by S_3 (7.57 days) (3:1 ratio).

Significant combined effects of media and spawn rate on days to require from opening to primordial initiation was observed (Table 3). The maximum days to require from opening to primordial initiation was recorded from M_3S_1 (9.40 days) (wheat with 1:1 ratio). On the other hand, the minimum days to require from opening to primordial initiation was observed in M_1S_4 (6.50 days) (paddy with 4:1 ratio).

4.3 Days to require from opening to harvest

There was significant variation in terms of days to require from opening to harvest of oyster mushroom due to different media (Table 1). The maximum days to require from opening to harvest was found from M_3 (12.55 days) (wheat media), followed by M_2 (12.05 days) (millet media), whereas the minimum was recorded in M_1 (11.43 days). Similar results were also reported by Khan *et al.* (2001); Dhoke *et al.* (2001); Royse *et al.* (1991). Khan *et al.* (2001) reported that time from opening to harvest vary from 10-15 days. Dhoke *et al.* (2001) found significant effect of different agro-wastes on that time from opening to harvest of oyster mushroom and the days required for the final picking complete from 12.25 to 13.50 days depending on different substrates.

Days to require from opening to harvest showed statistically significant variation due to spawn rate (Table 2). The maximum days to require from opening to harvest was recorded from S_1 (12.73 days) (1:1 ratio), followed by S_2 (12.20 days) (2:1 ratio), while the minimum days to require from opening to harvest was observed in S_4 (11.27 days) (4:1 ratio), followed by S_3 (11.83 days) (3:1 ratio).

Table 1. Effect of different media on mycelium growth and yield contributing characters of oyster mushroom

Media	Days to required from opening to primordial initiation	Days to required from opening to harvest	Number of effective fruiting body per packet	Single weight of fruiting body (g)
M_1	7.12 c	11.43 c	62.61 a	5.06 a
M_2	7.95 b	12.05 b	57.25 b	4.61 b
M_3	8.20 a	12.55 a	50.23 c	3.69 c
$LSD_{(0.05)}$	0.12	0.22	0.35	0.22
CV (%)	2.05	2.23	1.42	3.32

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

M_1 –Paddy,
M_2 –Millet and
M_3 – Wheat

Table 2. Effect of spawn rate on mycelium growth and yield contributing characters of oyster mushroom

Spawn rate	Days to required from opening to primordial initiation	Days to required from opening to harvest	Number of effective fruiting body per packet	Single weight of fruiting body (g)
S_1	8.43 a	12.73 a	49.01 d	3.94 d
S_2	7.97 b	12.20 b	55.14 c	4.33 c
S_3	7.57 c	11.83 c	58.38 b	4.61 b
S_4	7.07 d	11.27 d	64.27 a	4.94 a
$LSD_{(0.05)}$	0.14	0.25	0.40	0.25
CV (%)	2.05	2.23	1.42	3.32

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

S_1 – 1:1 ratio,
S_2 – 2:1 ratio,
S_3 – 3:1 ratio and
S_4 – 4:1 ratio

Significant combined effects of media and spawn rate on days to require from opening to harvest was observed (Table 3). The maximum days to require from opening to harvest was recorded from M_3S_1 (13.60 days) (wheat with 1:1 ratio). On the other hand, the minimum days to require from opening to harvest was observed in M_1S_4 (10.50 days) (paddy with 4:1 ratio).

4. 4 Number of fruiting body per packet

Number of fruiting body per packet of oyster mushroom varied significantly due to different media under the present trial (Figure 3). The highest number of fruiting per packet was observed from M_1 (70.54) (paddy media), which was followed by M_2 (64.54) (millet media), again the lowest number of fruiting body per packet was found in M_3 (59.75) (wheat media). The result of the present study supported with the previous findings (Amin, 2004; Sarker, 2004 and Dey, 2006). Amin (2004) in his experiment found that the highest number of fruiting body of oyster mushroom was found in sterilized paddy straw. Ahmed (1998) reported significantly different number of fruiting body on different media.

Bhuyan (2008) found similar findings when he growing oyster mushroom on rice straw supplemented with different levels of cow dung.

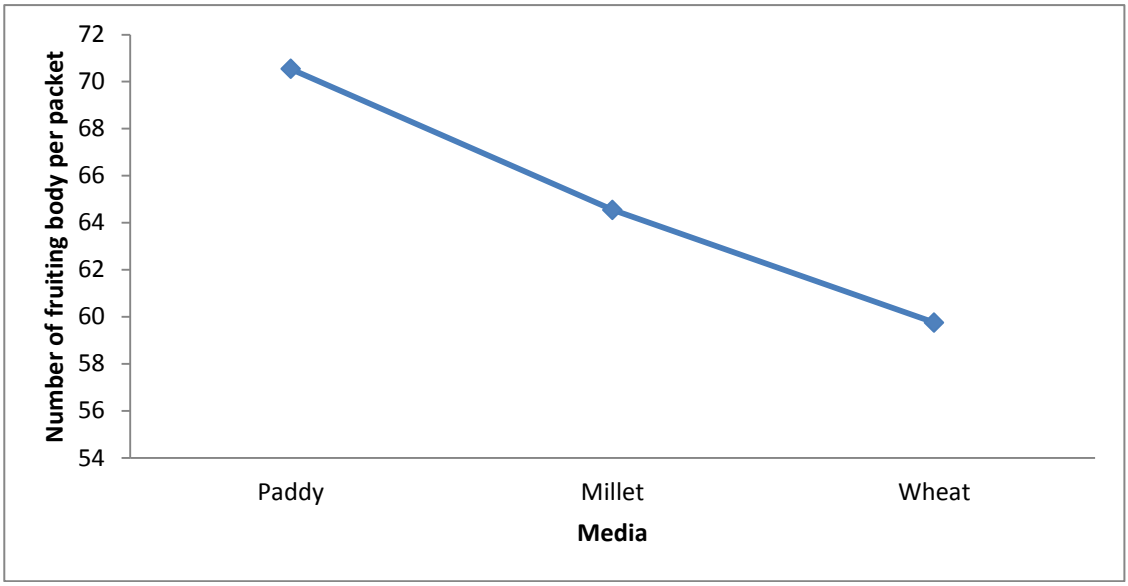


Figure 3. Effect of media on number of fruiting body per packet of oyster mushroom (LSD value = 0.47)

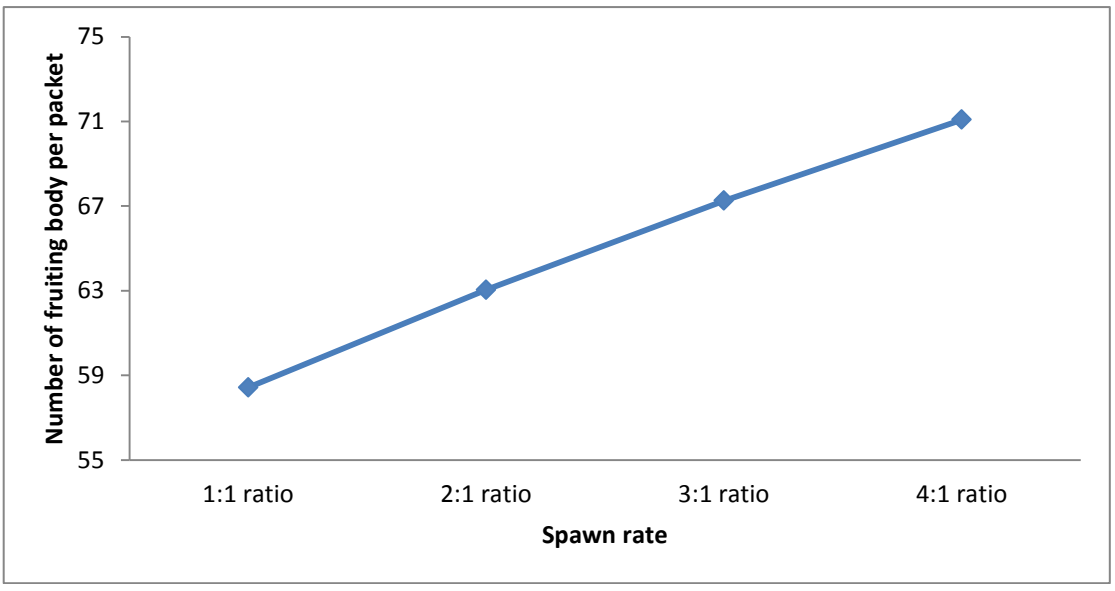


Figure 4. Effect of spawn rate on number of fruiting body per packet of oyster mushroom (LSD value = 0.54)

Significant variation of number of fruiting body per packet was found due to different spawn rate in all the studied durations (Figure 4). The highest fruiting body (71.08) was obtained from S_4 (4:1 ratio), followed by S_3 (67.25) (3:1 ratio) whereas, the lowest (58.42) was recorded in S_1 (1:1 ratio), followed by S2 (63.04) (2:1 ratio). Dey (2006) found that the number of fruiting body of oyster mushroom give the lowest value with sawdust.

Significant combined effects of different media and spawn rate on number of fruiting body per packet was observed in this experiment (Table 3). The highest fruiting body (75.63) was obtained from M_1S_4 (paddy with 4:1 ratio) and the lowest (50.25) was recorded in M_3S_1 (wheat with 1:1 ratio).

4.5 Number of effective fruiting body per packet

Significant variation was observed in case of number of effective fruiting body per packet of oyster mushroom (Table 1). The maximum number of effective fruiting body per packet (62.61) was recorded from M_1 (paddy media), followed by M_2 (57.25) (millet media), while the minimum number of effective fruiting body per packet was observed in M_3 (50.23) (wheat media). This variation might be due to variation among the media. The result of the present study found similar with the previous findings of Yoshida *et al.* (1993); Sarker (2004), Bhuyan (2008). Yoshida *et al.* (1993) reported that the number of effective fruiting bodies was lower, but increased when the media was mixed with different supplements. Sarker (2004) found that the number of effective fruiting body increased with the rice and rice straw media. Bhuyan (2008) in a same type of experiment found similar results.

Significant variation of number of effective fruiting body per packet was found due to different spawn rate in all the studied durations (Table 2). The highest effective fruiting body (64.27) was obtained from S_4 (4:1 ratio), followed by S_3 (58.38) (3:1 ratio) whereas, the lowest (55.14) was recorded in S_1 (1:1 ratio), followed by S2 (49.01) (2:1 ratio). Dey (2006) found that the number of effective fruiting body of oyster mushroom give the lowest value with sawdust.

Significant combined effects of different media and spawn rate on number of effective fruiting body per packet was observed in this experiment (Table 3). The highest effective fruiting body (71.38) was obtained from M_1S_4 (paddy with 4:1 ratio). On the other hand, the lowest effective fruiting body (38.26) was recorded in M_3S_1 (wheat with 1:1 ratio).

4.6 Single weight of fruiting body

Statistically variation was observed in case of single weight of fruiting body of oyster mushroom for different media under the present trial (Table 1). The maximum single weight of fruiting body was found from M_1 (5.06 g), which was followed by M_2 (4.61 g). On the other hand, the lowest single weight of fruiting body was found in M_3 (3.69 g). The findings of this experiment were also supported by the findings of Sarker *et al*. (2007) and Bhuyan (2008). Sarker (2004) found significant increase in weigh of fruiting body in gram per sporocarps over control in spawn packet containing different supplement in compared with rice media alone. Bhuyan (2008) found comparatively higher weigh of individual fruiting body ranged from (5.02g to 7.01g).

Single weight of fruiting body significantly influenced by different media (Table 2). The highest single weight of fruiting body (4.94 g) was produced from S_4 (4:1 ratio), followed by S_3 (4.61 g) (3: 1 ratio) whereas, the lowest (3.94 g) was counted from S_1 (1:1 ratio), followed by S_2 (2:1 ratio). Present study showed that single weight of fruiting body increased when decreased the sawdust percentage.

Combined effect of different media and spawn rate showed significant variation in respect of single weight of fruiting body (Table 3). The highest single weight of fruiting body (5.61 g) was recorded from the combination of paddy media with 4:1 ratio (M_1S_4) treatment whereas, the lowest (3.11 g) was recorded from the combination of 'wheat media with 1:1 ratio' (M_3S_1) treatment.

Table 3. Combined effect of media and spawn rate on mycelium growth and yield contributing characters of oyster mushroom

Treatments	Mycelium running rate in spawn packets (cm)	Days to required from opening to primordial initiation	Days to required from opening to harvest	Number of fruiting body per packet	Number of effective fruiting body per packet	Single weight of fruiting body (g)
M_1S_1	0.72 d	8.50 b	12.10 cd	66.50 e	57.50 f	4.60 de
M_1S_2	0.74 bc	7.30 ef	11.80 e	69.23 c	59.30 d	4.82 cd
M_1S_3	0.75 b	7.20 f	11.30 f	70.82 b	62.27 c	5.19 b
M_1S_4	0.83 a	6.50 g	10.50 g	75.63 a	71.38 a	5.61 a
M_2S_1	0.62 f	8.20 c	12.50 b	58.50 j	51.26 i	4.11 f
M_2S_2	0.68 e	7.80 d	12.30 bc	61.75 g	55.31 g	4.52 e
M_2S_3	0.73 cd	7.30 ef	11.90 de	67.30 d	59.50 d	4.83 cd
M_2S_4	0.75 b	8.20 c	11.50 f	70.62 b	62.94 b	5.00 bc
M_3S_1	0.52 g	9.40 a	13.60 a	50.25 i	38.26 k	3.11 h
M_3S_2	0.63 f	8.40 b	12.50 b	58.13 h	50.81 j	3.65 g
M_3S_3	0.68 e	7.70 d	12.30 bc	63.63 f	53.36 h	3.80 g
M_3S_4	0.72 d	7.40 e	11.80 e	67.00 de	58.50 e	4.20 f
$LSD_{(0.05)}$	0.02	0.14	0.25	0.54	0.40	0.25
CV (%)	3.09	2.05	2.23	1.49	1.42	3.32

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

Media
M_1 –Paddy,
M_2 –Millet and
M_3 – Wheat

Spawn rate
S_1 – 1:1 ratio,
S_2 – 2:1 ratio,
S_3 – 3:1 ratio and
S_4 – 4:1 ratio

4.7 Length of stalk(cm)

Length of stalk of oyster mushroom showed statistically significant variation and that might be due to different media under the present trial (Table 4). The longest length of stalk (5.58 cm) was recorded from M_1 (paddy media) which was statistically similar M_2 (5.42 cm) (millet media). On the other hand, the shortest length of stalk (5.26 cm) was found in M_3 (wheat media). Ahmed (1998) reported significant effects of various media on length of stalk. Habib (2005) found that the length of stalk of oyster mushroom on different media varied from 4.93cm to 5.97cm.

Length of stalk of oyster mushroom significantly influenced by different spawn rate (Table 5). The longest length of stalk (5.59 cm) was recorded from S_4 (4:1 ratio) which was statistically similar S_3 (5.45 cm) and S_2 (5.37 cm). On the other hand, the shortest length of stalk (5.29 cm) was observed from S_1 (1:1 ratio). Present study showed that length of stalk increased when decreased the sawdust percentage.

Combined effect of different media and spawn rate showed significant variation in respect of length of stalk (Table 6). The longest length of stalk (5.78 cm) was recorded from the combination of paddy media with 4:1 ratio' (M_1S_4) treatment which was statistically similar M_1S_3 (5.61 cm) and M_2S_4 (5.58 cm) whereas, the shortest (5.11 cm) was observed from the combination of 'wheat media with 1:1 ratio' (M_3S_1) treatment which was statistically similar M_3S_2 (5.25 cm), M_2S_1 (5.31 cm) and M_3S_3 (5.33 cm).

4.8 Diameter of stalk(cm)

Different media showed significant differences in terms of diameter of stalk of oyster mushroom (Table 4). The highest diameter of stalk was found from M_1 (1.43 cm) followed by M_2 (1.34 cm), whereas the lowest diameter of stalk was recorded in M_3 (1.27 cm). Ahmed (1998) reported significant effects of various media on diameter of stalk. Habib (2005) found that stalk of oyster mushroom on different substrates varied from 0.94 cm to 1.55 cm.

Different spawn rate had significant effect on diameter of stalk (Table 5). The highest diameter of stalk (1.44 cm) was found in S_4 (4:1 ratio), followed by S_3 (1.36 cm) (3:1 ratio) and the lowest (1.26 cm) was found from S_1 (1:1 ratio), followed by S_2 (1.32 cm) (2:1 ratio). The findings of this experiment were also supported by the findings of Sarker *et al*. (2007) and Bhuyan (2008). Sarker (2004) found significant increase in diameter of stalk over control in spawn rate containing different supplement in compared with sawdust alone.

It was found that diameter of stalk was affected significantly due to the combined of different media and spawn rate (Table 6). The highest diameter of stalk (1.51 cm) was recorded from M_1S_4 (paddy with 4:1 ratio). On the other hand, the lowest diameter of stalk (1.14 cm) was found from M_3S_1 (wheat with 1:1 ratio).

4.9 Length of pileus(cm)

There was non-significant variation in terms of length of pileus of oyster mushroom due to different media (Table 4). In numerically, the longest length of pileus was observed from M_1 (7.26 cm). On the other hand, the shortest length of pileus was found in M_3 (7.06 cm). Ahmed (1998) reported significant effects of various substrates on length of pileus. Habib (2005) found that length of pileus ranged from 6.45 cm to 7.70 cm due to different substrates.

Length of pileus of oyster mushroom significantly influenced by different spawn rate (Table 5). The longest length of pileus (7.34 cm) was recorded from S_4 (4:1 ratio) which was statistically similar S_3 (7.22 cm) and S_2 (7.12 cm). On the other hand, the shortest length of pileus (6.98 cm) was observed from S_1 (1:1 ratio). Present study showed that length of pileus increased when decreased the sawdust percentage.

Combined effect of different media and spawn rate showed significant variation in respect of length of pileus (Table 6). The longest length of pileus (7.50 cm) was recorded from the combination of paddy media with 4:1 ratio' (M_1S_4) treatment which was statistically similar M_2S_4 (7.33 cm) and M_1S_3 (7.32 cm) whereas, the shortest (6.86 cm) was observed from the combination of 'wheat media with 1:1 ratio' (M_3S_1) treatment which was statistically similar M_3S_2 (7.01 cm), M_2S_1 (7.04 cm) and M_1S_1 (7.05 cm).

Table 4. Effect of different media on length of stalk and pileus, diameter of stalk and pileus of oyster mushroom

Media	Length of stalk (cm)	Diameter of stalk (cm)	Length of pileus (cm)	Diameter of pileus (cm)
M_1	5.58 a	1.43 a	7.26	1.30 a
M_2	5.42 ab	1.34 b	7.17	1.21 b
M_3	5.26 b	1.27 c	7.06	1.16 c
$LSD_{(0.05)}$	0.22	0.01	NS	0.01
CV (%)	2.74	1.37	2.02	1.11

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

M_1 –Paddy,
M_2 –Millet and
M_3 – Wheat

Table 5. Effect of spawn rate on length of stalk and pileus, diameter of stalk and pileus of oyster mushroom

Spawn rate	Length of stalk (cm)	Diameter of stalk (cm)	Length of pileus (cm)	Diameter of pileus (cm)
S_1	5.29 b	1.26 d	6.98 b	1.12 d
S_2	5.37 ab	1.32 c	7.12 ab	1.20 c
S_3	5.45 ab	1.36 b	7.22 ab	1.23 b
S_4	5.59 a	1.44 a	7.34 a	1.33 a
$LSD_{(0.05)}$	0.25	0.02	0.24	0.02
CV (%)	2.74	1.37	2.02	1.11

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

S_1 – 1:1 ratio,
S_2 – 2:1 ratio,
S_3 – 3:1 ratio and
S_4 – 4:1 ratio

4.10 Diameter of pileus

Diameter of pileus of oyster mushroom varied significantly due to different media under the present trial (Table 4). The highest diameter of pileus was recorded from M_1 (1.30 cm), followed by M_2 (1.21 cm), again the lowest diameter of pileus was found in M_3 (1.16 cm). Ahmed (1998) reported significant effects of various substrates on diameter of pileus. He also found that lower diameter of pileus produced the lowest yield and concluded that the

diameter of pileus increased the quality and yield of mushroom and highest dry yield from mango rice straw. Habib (2005) found that the diameter of pileus ranged from 0.85 cm to 1.95 cm.

Different spawn rate had significant effect on diameter of pileus (Table 5). The highest diameter of pileus (1.33 cm) was found in S_4 (4:1 ratio), followed by S_3 (1.23 cm) (3:1 ratio) and the lowest (1.20 cm) was found from S_1 (1:1 ratio), followed by S_2 (1.12 cm) (2:1 ratio). The result of the present study found similar with the previous studies (Chowdhury *et al.,* 1998; Amin *et al.,* 2007 and Dhoke *et al.*, 2001). Amin *et al.* (2004) found the highest diameter of pileus 1.35 cm.

Table 6. Combined effect of media and spawn rate on length of stalk and pileus, diameter of stalk and pileus of oyster mushroom

Treatments	Length of stalk (cm)	Diameter of stalk (cm)	Length of pileus (cm)	Diameter of pileus (cm)
M_1S_1	5.45 b-d	1.38 e	7.05 cd	1.23 d
M_1S_2	5.51 bc	1.40 cd	7.18 bc	1.28 c
M_1S_3	5.61 ab	1.43 b	7.32 ab	1.30 b
M_1S_4	5.78 a	1.51 a	7.50 a	1.38 a
M_2S_1	5.31 c-e	1.27 h	7.04 cd	1.13 f
M_2S_2	5.38 b-d	1.31 g	7.13 bc	1.18 e
M_2S_3	5.41 b-d	1.35 f	7.20 bc	1.22 d
M_2S_4	5.58 ab	1.41 c	7.33 ab	1.30 b
M_3S_1	5.11 e	1.14 j	6.86 d	1.01 g
M_3S_2	5.25 de	1.25 i	7.01 cd	1.13 f
M_3S_3	5.33 c-e	1.30 g	7.14 bc	1.18 e
M_3S_4	5.41 b-d	1.39 de	7.21 bc	1.30 b
$LSD_{(0.05)}$	0.25	0.02	0.24	0.02
CV (%)	2.74	1.37	2.02	1.11

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

Media
M_1 –Paddy,
M_2 –Millet and
M_3 – Wheat

Spawn rate
S_1 – 1:1 ratio,
S_2 – 2:1 ratio,
S_3 – 3:1 ratio and
S_4 – 4:1 ratio

It was found that diameter of pileus was affected significantly due to the combined of different media and spawn rate (Table 6). The highest diameter of pileus (1.38 cm) was recorded from M_1S_4 (paddy with 4:1 ratio). On the other

hand, the lowest diameter of pileus (1.01 cm) was found from M_3S_1 (wheat with 1:1 ratio).

4.11 Biological yield

Biological yield of oyster mushroom showed statistically significant variation due to different media under the present trial (Figure 5). The highest biological yield (241.50 g) was recorded from M_1 (paddy media), followed by M_2 (222.10 g) (millet media), while the lowest biological yield (187.90 g) was recorded in M_3 (wheat media). The result of the present study found similar with the previous studies (Chowdhury *et al.,* 1998; Amin *et al.,* 2007 and Dhoke *et al.*, 2001). Amin *et al.* (2004) found the highest biological yield 247.30 g/packet. Chowdhury *et al.* (1998) examined the effects of adding different supplements to substrates for growing oyster mushrooms (*Pleurotus sajor-caju*) and found adding 5% supplements gave the highest yield of oyster mushroom. Dhoke *et al.* (2001) found significant effect of different agro-wastes on yield of oyster mushroom. Baysal *et al.* (2003) found the highest yield of Oyster mushroom (*Pleurotus ostreatus*) with the substrate composed of 20% rice husk in weigh.

Biological yield of oyster mushroom showed statistically significant variation due to different spawn rate under the present trial (Figure 6). The highest biological yield (231.40 g) was recorded from S_4 (4:1 ratio), followed by S_3 (221.70 g), while the lowest biological yield (199.70 g) was recorded in S_1 (1: 1 ratio), followed by S_2 (215.80 g).

It was found that biological yield was affected significantly due to the combined of different media and spawn rate (Table 9). The highest biological yield (255.90 g) was recorded from M_1S_4 (paddy with 4:1 ratio). On the other hand, the lowest biological yield (159.50 g) was found from M_3S_1 (wheat with 1:1 ratio).

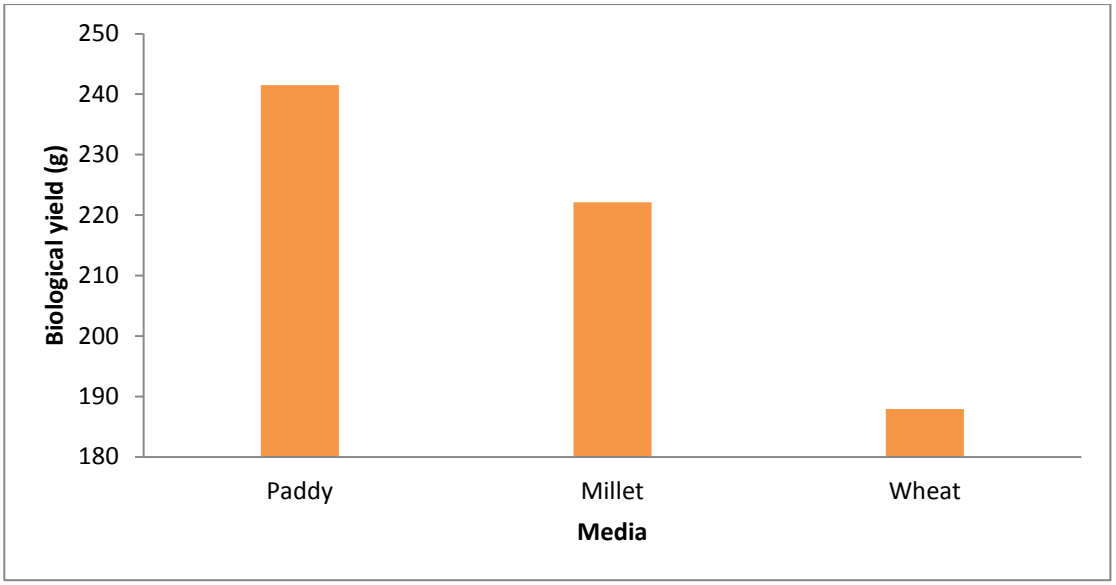


Figure 5. Effect of media on biological yield of oyster mushroom (LSD value = 1.43)

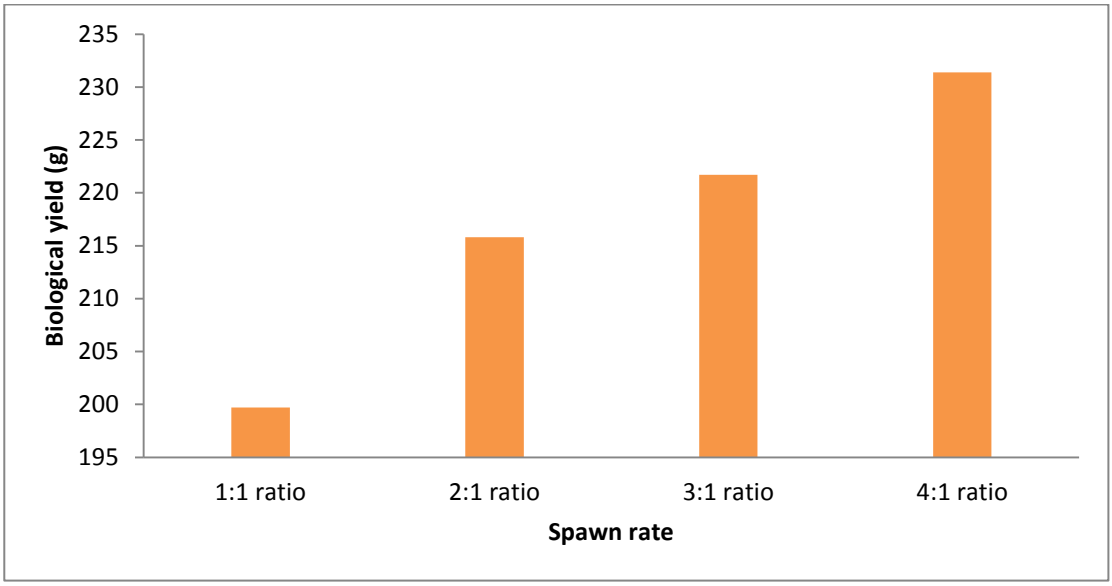


Figure 6. Effect of spawn rate on biological yield of oyster mushroom (LSD value = 1.66)

Table 7. Effect of different media on yield of oyster mushroom

Media	Economic yield (g)	Dry yield (g)
M_1	227.00 a	21.83 a
M_2	207.60 b	17.96 b
M_3	172.60 c	15.05 c
$LSD_{(0.05)}$	2.27	0.26
CV (%)	2.77	3.97

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

M_1 –Paddy,
M_2 –Millet and
M_3 – Wheat

Table 8. Effect of spawn rate on yield of oyster mushroom

Spawn rate	Economic yield (g)	Dry yield (g)
S_1	183.40 d	15.94 d
S_2	200.00 c	17.91 c
S_3	208.90 b	18.77 b
S_4	217.40 a	20.50 a
$LSD_{(0.05)}$	2.62	0.30
CV (%)	2.77	3.97

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

S_1 – 1:1 ratio,
S_2 – 2:1 ratio,
S_3 – 3:1 ratio and
S_4 – 4:1 ratio

4.12 Economic yield

Economic yield of oyster mushroom grown on different media showed statistically significant variation also (Table 7). The maximum economic yield (227.00 g) was recorded from M_1 (paddy media), followed by M_2 (207.60 g) (millet media), whereas the minimum economic yield (172.60 g) was observed in M_3 (wheat media). The findings of this experiment also supported by the earlier findings of Baysal *et al.* (2003) and Amin *et al.* (2007). Amin *et al.* (2007) found that the trend of economic yield corresponded with different media at different level. Baysal *et al.* (2003) found the highest yield of oyster mushroom (*Pleurotus ostreatus*) with the substrate composed of 20% rice husk in weight. Appreciable

variations in economic yield also observed at different levels of supplements under different substrate-supplement combinations. Payapanon *et al.* (1994) mentioned that suitable amount of supplements added to rice husk medium maximized economic yield of oyster mushroom at optimum production cost. Sarker (2004) found appreciable variations in economic yield also observed at different levels of supplements under different substrate-supplement combinations. Bhuyan (2008) observed that the yield of *Pleurotus ostreatus* responded with the levels of supplements used with rice straw and increased with the level of supplementation and declined there after.

Economic yield of oyster mushroom showed statistically significant variation due to different spawn rate under the present trial (Table 8). The maximum economic yield (217.40 g) was recorded from S_4 (4:1 ratio), followed by S_3 (208.90 g), while the minimum economic yield (183.40 g) was recorded in S_1 (1: 1 ratio), followed by S_2 (200.00 g).

It was found that economic yield was affected significantly due to the combined of different media and spawn rate (Table 9). The maximum economic yield (241.30 g) was recorded from M_1S_4 (paddy with 4:1 ratio). On the other hand, the minimum economic yield (143.40 g) was found from M_3S_1 (wheat with 1:1 ratio).

4.13 Dry yield

Significant variation was recorded in terms of dry yield of oyster mushroom due to different media (Table 7). The highest dry yield (21.83 g) was observed from M_1 (paddy media) followed by M_2 (17.96 g) (millet media). On the other hand, the lowest dry yield (15.05 g) was attained in M_3 (wheat media). The result of the present study was supported by the study of previous researcher Sarker *et al*. (2007) who found the range of dry yield ranged from 4.28 to 29.98 g/packet of *Pleurotus ostreatus* grown on different substrate. Kulsum *et al.* (2009) found that the highest dry yield was 21.27 g due to rice huck. Ahmed (1998) observed similar result in case of dry yield and it was related with the diameter of pileus.

Dry yield of oyster mushroom showed statistically significant variation due to different spawn rate under the present trial (Table 8). The highest dry yield (20.50 g) was recorded from S_4 (4:1 ratio), followed by S_3 (18.77 g), while the lowest dry yield (15.94 g) was recorded in S_1 (1: 1 ratio), followed by S_2 (17.91 g). Dhoke *et al.* (2001) found significant effect of different agro-wastes spawn rate on dry yield of oyster mushroom. Baysal *et al.* (2003) found the highest dry yield of Oyster mushroom (*Pleurotus ostreatus*) with the substrate composed of rice husk and sawdust (2:1 w/w) in weigh.

Table 9. Combined effect of media and spawn rate on yield of oyster mushroom

Treatments	Biological yield (g)	Economic yield (g)	Dry yield (g)
M_1S_1	228.60 e	208.40 f	18.75 d
M_1S_2	238.30 c	224.90 c	19.56 c
M_1S_3	243.10 b	233.50 b	22.52 b
M_1S_4	255.90 a	241.30 a	25.10 a
M_2S_1	211.20 h	198.40 h	16.24 h
M_2S_2	221.30 g	202.10 g	17.80 f
M_2S_3	225.50 f	211.60 e	18.25 e
M_2S_4	230.40 d	218.30 d	19.55 c
M_3S_1	159.50 l	143.40 l	12.82 k
M_3S_2	187.80 k	172.80 k	14.98 j
M_3S_3	196.50 j	181.60 j	15.53 i
M_3S_4	208.00 i	192.50 i	16.85 g
$LSD_{(0.05)}$	1.66	2.62	0.30
CV (%)	3.45	2.77	3.97

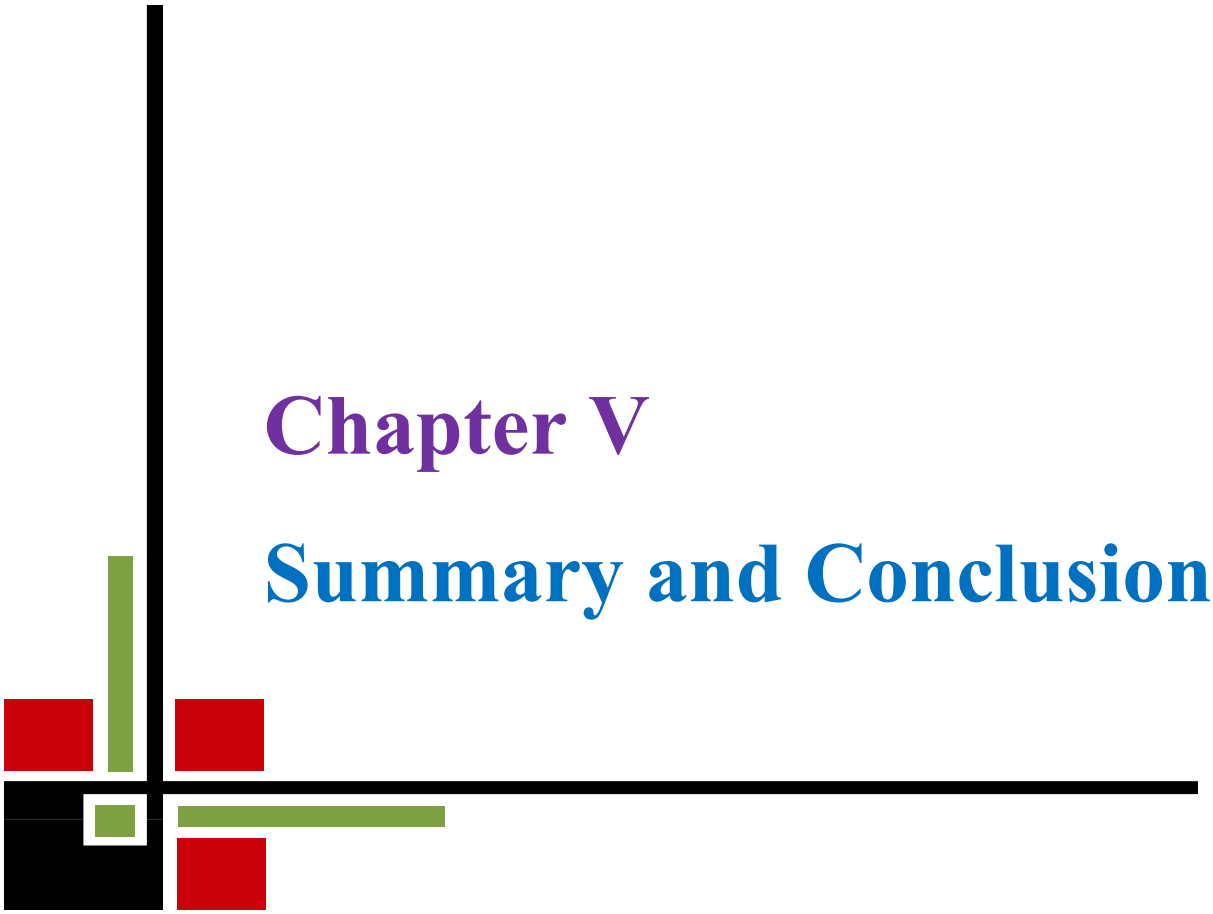
In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

Media
M_1 –Paddy,
M_2 –Millet and
M_3 – Wheat

Spawn rate
S_1 – 1:1 ratio,
S_2 – 2:1 ratio,
S_3 – 3:1 ratio and
S_4 – 4:1 ratio

It was found that dry yield was affected significantly due to the combined of different media and spawn rate (Table 9). The highest dry yield (25.10 g) was

recorded from M_1S_4 (paddy with 4:1 ratio). On the other hand, the lowest dry yield (12.82 g) was found from M_3S_1 (wheat with 1:1 ratio).



Chapter V

Summary and Conclusion

CHAPTER V

SUMMARY AND CONCLUSIONS

The experiment was conducted at the Laboratory and Culture house of Mushroom Development and Extension Programme, Mushroom Development Institute, Sobhanbang, Savar, Dhaka during January to July, 2014. Mother culture of oyster mushroom was collected from Mushroom Development Institute (MDI), Savar, Dhaka. Oyster mushroom is *Pleurotus djamor* var. *roseus* that has a light to dark pink colored cap depending the growing conditions. The experiment consists of two factors design with three replications. Factor A: different media viz., M_1 = Paddy, M_2 = Millet, M_3 = Wheat and Factor B: spawn rate viz., S_1 = 1:1 ratio (Media : Sawdust), S_2 = 2: 1 ratio (Media : Sawdust), S_3 = 3: 1 ratio (Media : Sawdust), S_4 = 4: 1 ratio (Media : Sawdust). The experiment was laid out in two factors Completely Randomized Design (CRD).

There was significant variation in terms of mycelium running rate, days to require from opening to primordial initiation, days to require from opening to harvest, number of fruiting body per packet, number of effective fruiting body per packet, single weight of fruiting body, length of stalk, diameter of stalk, diameter of pileus, biological yield, economic yield and dry yield but was non-significant variation in term of length of pileus of oyster mushroom due to different media. The highest mycelium running rate (0.76 cm), number of fruiting per packet M_1 (70.54), number of effective fruiting body per packet (62.61), single weight of fruiting body (5.06 g), length of stalk (5.58 cm), diameter of stalk (1.43 cm), length of pileus (7.26 cm), diameter of pileus (1.30 cm), biological yield (241.50 g), economic yield (227.00 g) and dry yield (21.83 g) was observed from M_1 (paddy media) treatment. The maximum days to require from opening to primordial initiation (8.20 days) and days to require from opening to harvest (12.55 days) was found from M_3 (wheat media) treatment.

There was significant variation in terms of mycelium running rate, days to require from opening to primordial initiation, days to require from opening to harvest, number of fruiting body per packet, number of effective fruiting body per packet, single weight of fruiting body, length of stalk, diameter of stalk, length of pileus, diameter of pileus, biological yield, economic yield and dry yield of oyster mushroom due to different media. The highest mycelium running rate (0.77 cm), number of fruiting body (71.08), number of effective fruiting body (64.27), single weight of fruiting body (4.94 g), length of stalk (5.59 cm), diameter of stalk (1.44 cm), length of pileus (7.34 cm), diameter of pileus (1.33 cm), biological yield (231.40 g), economic yield (217.40 g) and dry yield (20.50 g) was recorded from S_4 (4:1 ratio) treatment. The maximum days to require from opening to primordial initiation (8.43 days) and days to require from opening to harvest (12.73 days) was recorded in S_1 (1:1 ratio) treatment.

Significant Interaction effects of different media and different spawn rate on mycelium running rate, days to require from opening to primordial initiation, days to require from opening to harvest, number of fruiting body per packet, number of effective fruiting body per packet, single weight of fruiting body, length of stalk, diameter of stalk, length of pileus, diameter of pileus, biological yield, economic yield and dry yield of oyster mushroom was observed in this experiment. The highest mycelium running rate (0.83 cm), number of fruiting body (75.63), number of effective fruiting body (71.38), single weight of fruiting body (5.61 g), length of stalk (5.78 cm), diameter of stalk (1.51 cm), length of pileus (7.50 cm), diameter of pileus (1.38 cm), biological yield (255.90 g), economic yield (241.30 g) and dry yield (25.10 g) was recorded from M_1S_4 (paddy with 4:1 ratio). The maximum days to require from opening to primordial initiation (9.40 days) and days to require from opening to harvest (13.60 days) was recorded from M_3S_1 (wheat with 1:1 ratio).

In this experiment, paddy media with media substance ratio 4:1 (M_1S_4) and 3:1 (M_1S_3) gave the better performance in growth and yield of oyster mushroom .

Recommendation

Considering the above observation of the present study further investigation On More other treatments of media and spawn rate may be needed to include for future study as sole or different combination.

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Appendices

APPENDICES

Appendix I. Monthly record of air temperature, rainfall, relative humidity, soil temperature and Sunshine of the experimental site during the period from January 2014 to July 2014

Month	Average air temperature (°C)			Average relative humidity (%)	Total rainfall (mm)	Total Sunshine per day (hrs)
	Maximum	Minimum	Mean			
January, 2014	29.7	20.1	24.9	65	5	6.4
February, 2014	26.9	15.8	21.35	68	0	7.0
March, 2014	24.6	12.5	18.7	66	0	5.5
April, 2014	36.0	24.6	30.3	83	137	4.1
May, 2014	36.0	23.6	29.8	81	145	3.9
June, 2014	35.0	22.0	29.3	86	291	3.5
July, 2014	36.5	24.1	30.3	85	284	3.7

Source: Bangladesh Meteorological Department (Climate & weather division), Agargoan. Dhaka – 1212

Appendix II. Analysis of variance (mean square) of mycelium running rate, days to require from opening to primordial initiation, days to require from opening to harvest, number of fruiting body, number of effective fruiting body, single weight of fruiting body

Source of variation	Degrees of freedom	Mycelium running rate in spawn packets (cm)	Days to required from opening to primordial initiation	Days to required from opening to harvest	Number of fruiting body per packet	Number of effective fruiting body per packet	Single weight of fruiting body (g)
A	2	215.374*	215.374*	19.650**	19.638**	30.884**	49.245*
B	3	204.549**	204.549**	38.666*	38.647*	16.237**	49.026*
A×B	6	9.703*	9.703*	6.316*	6.315*	0.777*	3.452**
Error	24	2.516	2.516	7.787	7.785	0.422	8.520

* and ** indicate significant at 5% and 1% level of probability, respectively

Appendix III. Analysis of variance (mean square) of length of stalk, diameter of stalk, length of pilues and diameter of pilues

Source of variation	Degrees of freedom	Length of stalk (cm)	Diameter of stalk (cm)	Length of pileus (cm)	Diameter of pileus (cm)
A	2	15.230*	39.874*	82.572*	121.619*
B	3	21.646**	65.472**	43.932**	55.751**
A×B	6	0.625**	0.450**	0.806**	0.908**
Error	24	2.261	1.503	3.561	4.177

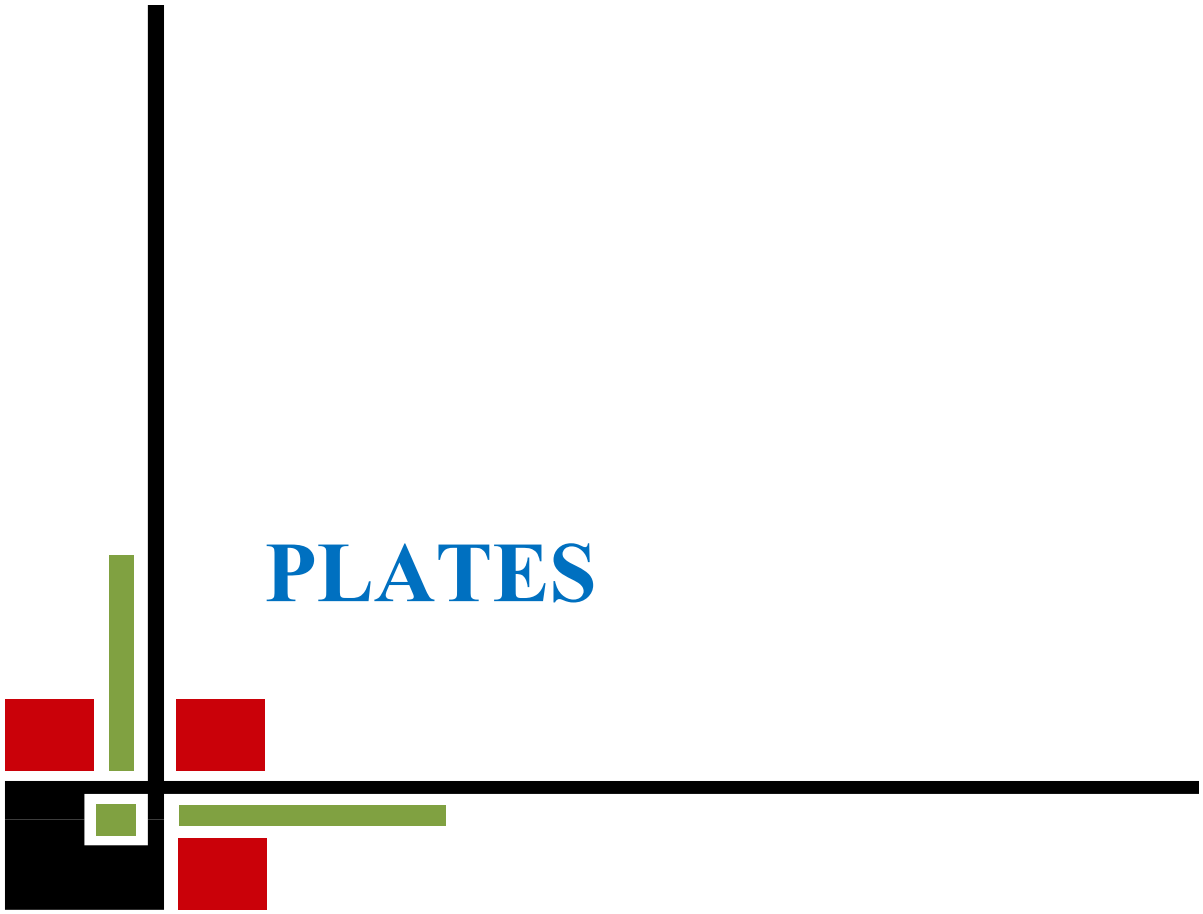
* and ** indicate significant at 5% and 1% level of probability, respectively

Appendix IV. Analysis of variance (mean square) of biological yield, economic yield and dry yield

Source of variation	Degrees of freedom	Biological yield (g)	Economic yield (g)	Dry yield (g)
A	2	10.583*	11.172**	146.764*
B	3	23.028**	11.431**	52.306*
A×B	6	3.824*	0.617**	11.713*
Error	24	2.417	0.024	14.903

* and ** indicates significant at 5% and 1% level of probability, respectively.

PLATES



PLATE

Plate 1. Preparation of rice media

Plate 2. Sawdust substances

Plate 3. Produced oyster mushroom of different media and spawn rate

Plate 4. Harvested oyster mushroom

Plate 5. Harvested oyster mushroom

Plate 6. Harvested oyster mushroom