American Journal of Food Science and Technology, 2015, Vol. 3, No. 6, 150-157
Available online at http://pubs.sciepub.com/ajfst/3/6/2

DOI:10.12691/ajfst-3-6-2

Effect of Wheat Bran Supplement with Sugarcane Bagasse on Growth, Yield and Proximate Composition of Pink Oyster Mushroom (*Pleurotus djamor*)

M. T. Hasan[1], M. H. A. Khatun[2,*], M. A. M. Sajib[3], M. M. Rahman[4], M. S. Rahman[1], M. Roy[4], M. N. Miah[1], K. U. Ahmed[1]

[1]Department of Biochemistry, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh
[2]Department of Food Technology & Rural Industries, Bangladesh Agricultural University, Mymensingh, Bangladesh
[3]Department of Food Technology, Engineering and Nutrition, Lund University, SE Lund, Sweden
[4]Department of Food Engineering and Tea Technology, Shahjalal University of Science and Technology, Sylhet, Bangladesh
*Corresponding author: suavekobita@gmail.com

Abstract This study evaluated the effect of supplementing different levels of wheat bran with sugarcane bagasse on the production of pink oyster mushroom (*Pleurotus djamor*) and find out their yield and proximate composition. The sugarcane bagasse was mixed at spawning with 0%, 10%, 20%, 30%, 40%, and 50% of wheat bran supplement and arranged in a complete randomized design with three replications, three spawn packets in each replication and six treatments. Result showed significantly ($P<0.01$) different, the highest mycelium running rate was observed on 40% and lowest on 0% due to using different levels of wheat bran supplement. Number of days from stimulation to primordia initiation and harvest, sugarcane bagasse supplemented with 30% wheat bran took longer time (5.5 days) for primordia and (5 days) to harvest, while 20% took shorter time (6.8 days) to full colonization. 10% supplement provided highest result in term of average number of primordia/packet (176.3), fruiting body/packet (77.6) and weight/fruiting body (5.3 g). The growth of pileus and stipe were significantly ($P<0.05$ (stipe length, pileus thickness) and $P<0.01$ (diameter)) different, being highest diameter on 30%, stripe length on 10% and pileus thickness on 40%. The yields of pink oyster mushroom showed significantly ($P<0.01$) different result, biological yield, economic yield, dry yield, biological efficiency and cost benefit ratio were obtained higher with 10% wheat bran supplement. The maximum moisture content was determined on 50%, dry matter, ash on 20% and protein content, crude fiber on 30%. 50% supplement was accounted for the highest amount of nitrogen, iron and phosphorus, whereas the quantity of calcium, magnesium and zinc were higher on 20%, Potassium on 40% and sulfur on 30% supplement. Thus, 10% wheat bran supplementation with sugarcane bagasse proved to be a viable option to produce pink oyster mushroom due to economical effectiveness while any supplementation above this level might reduce the yield of mushroom significantly.

Keywords: *wheat bran, sugarcane bagasse, pink oyster mushroom, proximate composition, supplementation, pleurotus djamor, biological efficiency*

Cite This Article: M. T. Hasan, M. H. A. Khatun, M. A. M. Sajib, M. M. Rahman, M. S. Rahman, M. Roy, M. N. Miah, and K. U. Ahmed, "Effect of Wheat Bran Supplement with Sugarcane Bagasse on Growth, Yield and Proximate Composition of Pink Oyster Mushroom (*Pleurotus djamor*)." *American Journal of Food Science and Technology*, vol. 3, no. 6 (2015): 150-157. doi: 10.12691/ajfst-3-6-2.

1. Introduction

Bangladesh is an agrarian based country with increasing number of population; available land for cultivation is decreasing day by day in order to accommodate vast population. Using conventional agricultural methods it is hard to fulfill the demand of food supply for this increased number of population. Now, we have to increase intensive use of land to increasing crop production. But it is very difficult in countries like Bangladesh due to weather condition, natural calamities and other barriers. At this time, we could meet our protein need from fish as well as energy from rice which is two more staple food of Bangladesh. In last decade, the fish production decreased considerably and we had to meet our protein need from vegetable source i.e. pulse. But now-a-days this is also much more expensive and it's a high time to find out an alternative source of protein as well as to introduce methods to increase production per unit area with the vertical use of land. Mushroom, which is a highly nutritious, delicious, medicinal and economically potential vegetable can be a solution to this.

Mushrooms are large reproductive structures of edible fungi belong to the class of Basidiomycetes or Ascomycetes. Approximately 0.3 million varieties of mushrooms are identified. Among them which are fully edible and have no toxic effect are to be considered as edible mushroom. Out of 2000 species of prime edible mushrooms about 80 have been grown experimentally, 20 cultivated commercially and 4-5 produced on industrial scale throughout the world [1]. The vegetative part of mushroom consists of thread like long thin mycelium which under suitable condition forms fruiting body or sporocarps. This fruiting body is used as edible mushroom.

Oyster mushrooms are the easiest and least expensive commercial mushrooms to grow because they are well known for conversion of crop residues to food protein [2]. Oyster mushroom (*Pleurotus ostreatus*) is an edible mushroom having excellent fragrant and taste and its cultivation on crop residues is considered as potential source of income, an alternative food production, provision of employment, and for recycling of agricultural wastes. The market for mushrooms has been reported to be on a continuous growth due to the interest in their culinary, nutritional, health benefits and their potential for use in waste management [3]. Pink oyster mushroom comes with the scientific name *Pleurotus djamor* var. *roseus* that has a light to dark pink colored cap depending upon the strain and growing conditions.

Figure 1. Pink oyster mushroom (*Pleurotus djamor*) [4]

Primordia and young mushrooms are bright pink but become less intensely colored as the mushroom matures. The color disappears entirely after cooking. The Pink oyster mushroom is one of the fastest growing *Pleurotus* species and can readily colonize on any kind of agricultural waste including wheat or paddy straw, sawdust, sugarcane bagasse. The fruit body formation also takes very less time as compared to all other *Pleurotus spp*.

Report showed that oyster mushrooms are one of the most delicious foods due to their high nutritional value, very good taste and medicinal value [5]. The low calorie and cholesterol free mushroom diets also display certain medicinal properties. Mushroom reduces the diabetic on regular feeding [6]. It also reduces the serum cholesterol in human bodies which reduces hypertension [7]. Mushroom inhibits the growth of tumor and cancer. Edible mushrooms have been treated as important tool in modern medicine for their medicinal values. 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 [1]. It is rich in essential minerals and trace elements [8]. 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. [9]

Substrate plays an important role in the yield and nutrient content of oyster mushroom. The substrates on which mushroom spawn (Merely vegetative seed materials) is grown, affects the mushroom production. [10] A remarkable variation observed in nutritional content of oyster mushroom in different substrates [11]. Mushroom cultivation has been shown to exploit the natural ability of fungi to bio-divert solid waste generated by industry and agriculture into food and therefore many agricultural and industrial wastes can be utilized as substrates for production of *Pleurotus species* [12]. The mushroom mycelia requires specific nutrients for its growth and the addition of supplements increases mushroom yield by providing specific nutrients for the mycelium growth [13]. Cereal bran rich in protein is usually added to the substrate in *P. ostreatus* cultivation to stimulate mycelia growth and increase the yield of mushroom [14]. The objective of this work was to evaluate the effects of wheat bran supplementation on the growth and productivity of pink oyster mushroom, with a view to know the physio-chemical characteristics of pink oyster mushroom (*Pleurotus djamor*).

2. Material and Methods

The experiment was carried out at the laboratory of Department of Biochemistry and Mushroom Culture House (MCH), Sher-e-Bangla Agricultural University, Dhaka-1207. *Pleurotus djamor*, the most cultivated pink oyster mushroom in Bangladesh was used to perform this study.

2.1. Sample Collection

Mother culture of Pink Oyster Mushroom was collected from National Mushroom Development and Extension Center (NAMDEC), Savar, Dhaka.

2.2. Varietal Characteristics of Pink Oyster Mushroom

Pink oyster mushroom (*Pleurotus djamor*) 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°C, its production markedly decreases.

2.3. Design of Experiments

Six different experiments with six treatments with three replications were conducted to achieve the desired objectives. The treatments were as follows:

T_1: Sugarcane bagasse supplemented + wheat bran@ 0% (Control)

T_2: Sugarcane bagasse supplemented + wheat bran @ 10%

T_3: Sugarcane bagasse supplemented + wheat bran @ 20%

T_4: Sugarcane bagasse supplemented + wheat bran @ 30%

T_5: Sugarcane bagasse supplemented + wheat bran @ 40%

T_6: Sugarcane bagasse supplemented + wheat bran @ 50%

The experiment was laid out in single factor Completely Randomized Design (CRD). The experiment included six treatments with three replications and three spawn packets in each replication.

2.4. Substrate Preparation

Spawn packets using different levels of supplements were prepared separately. With spawn preparing substrate;

different supplements (at the different rate on dry weight basis) and $CaCO_3$ (1 g per packet) was added. The measured materials were taken in a plastic bowl and mixed thoroughly by hand and moisture was increased by adding water. Moisture was measured by using the moisture analyzer and adjusted the moisture content at 65%.

2.4.1. Preparation of Spawn Packets

The mixed substrates were filled into 9×12 inch polypropylene bag at rate 750 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.

2.4.2. Sterilization, Inoculation and Mycelium running in Spawn Packets

The packets were sterilized about 1 hrs and then these were kept for cooling. After cooling, 5g mother spawn were inoculated into the packets in the laminar airflow cabinet and were kept at 20-22°C temperature until the packets become white with the mushroom mycelium. After completion of the mycelium running the rubber band, brown paper, cotton plug and plastic neck of the mouth of spawn packet were removed and the mouth was wrapped tightly with rubber band. Then these spawn packets were transferred to the culture house.

2.4.3. 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. Then the spawn packets were soaked in water for 15 minutes and invested to remove excess water for another 15 minutes. The packets of each type were placed separately on the floor of culture room and covered with paper. The moisture of the culture room was maintained 80-85% relative humidity by spraying water 3 times a day. The light around 300-500 lux and ventilation of culture house was maintained uniformly. The temperature of culture house was maintained 22°C to 25°C. The first primordia appeared 2-4 days after scribing depending upon the type of substrate. The harvesting time also varied depending upon the type of substrate.

2.4.4. Collection of Produced Mushrooms

Pink oyster mushrooms matured within 2-3 days after primordia initiation. The matured fruiting body was identified by curial margin of the cap. Mushrooms were harvested by twisting to uproot from the base.

2.5. Growth and Yield Analysis of Oyster Mushroom

The parameters measured were number of contaminated bags, number of days for substrate colonization, mushroom pileus diameter (cm), stipe length (cm), thickness of pileus and stripe (cm), total mushroom yield (g), biological efficiency (BE) and proximate composition and their mineral content.

2.6. Proximate Composition Analysis of Oyster Mushroom

The moisture content, dry matter, total fat, ash and carbohydrate content were determined by the standard AOAC method [15] and the estimation of total protein was made by method described by Ronald and Ronald [16]. Crude fibre was estimated by the process of Ranganna [17].

2.7. Elementary Composition Analysis

In order to investigate the mineral content of oyster mushroom the main elements including Nitrogen, Sulphur, potassium, magnesium, calcium, iron, zinc and phosphorus were determined based on the methods of AOAC [15,18].

2.8. Statistical Analysis of Data

The data for the characters considered in the present experiments were statistically analyzed following the Complete Randomized Design (CRD) and Randomized Complete Block Design (RCBD) method. The analysis of variance was conducted and means were compared following least significant difference (LSD) test at 1% and 5% level of probability for interpretation of results.

3. Results and Discussion

3.1. Mycelium Running Rate (cm)

Mycelium running rate per day (MRR) for each type of substrates was measured after the mycelium colony crossed the shoulder of the packet. The linear length was measured at different places of packet. The mycelium running rate of oyster mushroom greatly influenced with the supplement of wheat brans in different levels. The highest running rate was observed in 50% (0.96 cm) and in 0% (0.72 cm). The other treatments varied significantly over control.

3.2. Time Required from Stimulation to Initiation of Priomordia

The time from stimulation to primordia initiation ranged from 3.33 days to 5.50 days. The highest time from stimulation to primordia initiation was observed in 30% (5.50 days). Duration of primordia initiation to first harvest of oyster mushroom was significantly lower as compared to control where no supplement was used and the duration required for total harvest of oyster mushroom increased with the level of supplement used. In the present study, the time required for total harvest also decreased with the levels of supplements increased compared to sugarcane bagasse alone.

3.3. Time Required from Priomordia Initiation to Harvest

The lowest time from primordia initiation to harvest was in 20% (3.39 days) and the highest time from primordia initiation to harvest was observed in 30% (5.00 days) followed by 50% (4.50 days). Spawn running pinhead formation took 7-8 days and fruiting body formed after 3-5 days, sporocarps harvested after 10-12 days. A comparison of the data among different treatments is shown on Table 1.

Table 1. Growth and Time of full Colonization of Pink Oyaster Mushroom on Wheat Bran

Treatments	Mycelium running rate in spawn packet (cm)	Time from Stimulation to Priomordia Initiation (days)	Time from Priomordia Initiation to Harvest (days)
T_1 (0%)	0.72^{e}	3.333^{b}	4.220^{b}
T_2 (10%)	0.78^{d}	3.333^{b}	4.167^{b}
T_3 (20%)	0.87^{c}	3.387^{b}	3.390^{c}
T_4 (30%)	0.91^{b}	5.500^{a}	5.000^{a}
T_5 (40%)	0.96^{a}	4.000^{b}	4.333^{b}
T_6 (50%)	0.79^{d}	4.167^{b}	4.500^{ab}
CV (%)	0.71	13.57	6.76
Level of Significance	**	**	**
LSD (0.05)	0.028	0.9763	0.5241

Means followed by same letter significantly different at 1% or 5% level of significance. ^{NS} Not significant * Significant at 5% level; ** Significant at 1% level.

3.4. Average Number of Primordia/Packet

The highest average number of primordia/packet was observed in 10% (176.3) followed by 20% (159.0), 30% (148.0) and 50% (146.0) and the lowest average number of primordia/packet were in 0% (75.33). The number of primordia and the average yield significantly varied with the substrates used in production of oyster mushroom.

3.5. Average Number of Fruiting Body/Packet

The highest average number of fruiting body/packet was observed in 10% (77.67) followed by 30% (69.67) and the lowest average number of fruiting body /packet were in 50% (49.00). The number of primordia increased with the levels of supplement and continued up to a certain range and decline thereafter. In the present study the average number of fruiting body in creased up to 10 % of cow dung used as supplement and decreased thereafter.

3.6. Average Weight of Individual Fruiting Body

The average weight of individual fruiting body in different treatment ranged from 2.167 g to 5.283 g. The highest average weight of individual fruiting body was observed in 10% (5.283 g) and the lowest average weight of individual fruiting body was in 30% (2.167 g). The effect of supplementation on the weight of fruiting body was comparatively higher ranged from (5.02g to 7.01g) which may be due to environmental conditions or growing season [19]. Table 2 shows the effect of different levels of wheat bran with sugarcane bagasse on the yield contributing characters of the studied mushroom.

Table 2. Effect of different levels of wheat bran with sugarcane bagasse on the yield contributing characters

Treatments	Avg. no of primordia/packet	Avg. no of fruiting body/packet	Avg. wt. of individual fruiting body (g)
T_1 (0%)	75.33 b	55.33a	5.127 a
T_2 (10%)	176.3 a	77.67a	5.283 a
T_3 (20%)	159.0 a	64.33a	4.017 ab
T_4 (30%)	148.0 a	69.67a	2.167 c
T_5 (40%)	116.0 ab	65.33a	3.860 abc
T_6 (50%)	146.0 a	49.00a	3.150 bc
CV (%)	24.80	24.80	24.76
Level of Significance	*	ns	*
LSD (0.05)	61.72	28.68	1.772

Means followed by same letter significantly different at 1% or 5% level of significance.
^{NS} Not significant * Significant at 5% level; ** Significant at 1% level.

3.7. Effect on Dimension of Fruiting Body

The highest average length of stipe was observed in the treatment 10% (1.940 cm) and the lowest length and diameter in 50% (0.996 cm and 0.60 cm) respectively. The highest average diameter of stipe was observed in 30% (1.15 cm). The length of stipe of oyster mushroom on different substrates varied from 1.93cm to 2.97cm and the diameter ranged from 0.74cm to 1.05cm. 30% wheat bran supplement showed the highest average diameter (6.53 cm) of pileus and the lowest in 50% (5.68 cm). The highest average thickness of pileus was observed in 50% (0.616 cm) and the lowest in 10% (0.380 cm). The diameter of pileus ranged from 4.85 cm to 8.95 cm and thickness of the pileus ranged from 0.45cm to 0.70cm due to different substrates. The results are shown on Table 3.

Table 3. Effect of different substrates on the dimension of fruiting body of pink oyster mushroom

Treatments	Length of stipe (cm)	Diameter of stipe (cm)	Diameter of pileus (cm)	Thickness of pileus (cm)
T_1 (0%)	1.6201^{ab}	0.72^{d}	5.82^{d}	0.38^{b}
T_2 (10%)	1.940^{a}	0.86^{c}	5.98^{c}	0.46^{b}
T_3 (20%)	1.917^{a}	0.97^{b}	6.27^{b}	0.46^{b}
T_4 (30%)	1.393^{ab}	1.15^{a}	6.53^{a}	0.43^{b}
T_5 (40%)	1.200^{b}	0.82^{d}	6.34^{b}	0.61^{a}
T_6 (50%)	0.9967^{b}	0.78^{e}	5.96^{c}	0.45^{b}
CV (%)	0.6559	0.086	0.128	0.1286
Level of Significance	*	**	**	*
LSD (0.05)	23.84	1.03	1.01	14.75

Means followed by same letter significantly different at 1% or 5% level of significance.
^{NS} Not significant * Significant at 5% level; ** Significant at 1% level.

3.8. Biological Yield

The supplementation of sugarcane bagasse with wheat bran had great effect on biological yield. The highest biological yield was acounted for 10% (379.5 g) and lowest in 30% (154.7 g). The highest yield of Oyster mushroom (*Pleurotus ostreatus*) with the substrate composed of 20% rice husk. The highest biological yield was 247.3g/packet and the trend of economic yield corresponded with different supplements at different level.

3.9. Economic Yield

The supplementation of sugarcane bagasse with wheat bran increases the economic yield over control. The highest economic yield was recorded under treatment 10% (386.6 g) and lowest in 30% (151.9 g). The yield of *Pleurotus ostreatus* responded with the levels of supplements used with sawdust and increased with the level of supplementation and declined thereafter.

3.10. Dry Yield

The dry yield of the oyster mushroom, grown on sugarcane bagasse responded significantly in terms of dry yield with the different levels of supplement (wheat bran). The dry yield of mushroom was higher in 10% (12.47.40 g) and minimum in 0% (8.637 g). The diameter of pileus increased the quality and yield of mushroom and highest dry yield from mango sawdust and the range of dry yield from 4.28 g to 29.98 g.

3.11. Biological Efficiency

The highest biological efficiency was calculated in treatment 10% (50.59%) and lowest in 30% (20.62 %). The biological efficiency for different substrates ranged from 35.2 to 60.9 % and its differs due to combined supplements with basal ingredient that results better mushroom quality as well as Biological efficiency.

3.12. Cost Benefit Ratio

The highest cost benefit ratio was calculated in treatment 10% (5.02) and lowest 0% (ratio 4.22) was. The other treatments differed significantly in terms of cost benefit ratio. The performances of substrates were significantly differed based on benefit cost ratio, the highest cost benefit ratio of 6.50 with wheat straw. Results related to cost benefit ratio is provide on Table 4.

Table 4. Effect of different levels of wheat bran with sugarcane bagassee on the yield, biological efficiency and cost benefit ratio

Treatments	Biological yield (g)	Economic yield (g)	Dry yield (g)	Biological efficiency (%)	Cost benefit ratio
T_1 (0%)	156.2^c	154.1^c	8.637^f	36.893^b	4.22^f
T_2 (10%)	379.5^a	386.6^a	12.47^a	50.593^a	5.02^a
T_3 (20%)	299.2^b	293.2^b	9.700^e	39.890^b	4.71^c
T_4 (30%)	154.7^c	151.9^c	11.34^c	20.62^c	4.37^e
T_5 (40%)	255.4^b	252.0^b	10.70^d	34.053^b	4.86^b
T_6 (50%)	276.7^b	272.1^b	11.82^b	20.827^c	4.48^d
CV (%)	16.32	16.16	0.66	16.32	0.153
Level of Significance	**	**	**	**	**
LSD (0.05)	75.29	73.99	0.1286	10.04	1.70

Means followed by same letter significantly different at 1% or 5% level of significance.
^{NS} Not significant * Significant at 5% level; ** Significant at 1% level.

3.13. Effect on Proximate Composition

A graphical presentation showing the effects of different treatment on proximate composition is provide on Figure 2 as well as the data table can be seen on Table 5.

Table 5. Effect of different levels of wheat bran with sugarcane bagassee on chemical composition of pink oyster mushroom

Treatments	**Moisture** (%)	**Dry matter** (%)	**Protein** (%)	**Lipid** (%)	**Ash** (%)	**Carbohydrate** (%)	**Crude fiber** (%)
0%	90.3^{abc}	9.630^{cd}	19.44^f	5.870^b	7.890^f	54.70^a	20.24^e
10%	89.85^c	9.530^d	23.5^e	6.343^a	8.757^d	49.01^b	22.65^c
20%	90.33^{ab}	10.02^a	25.6^c	3.580^f	9.510^a	38.54^d	21.37^d
30%	90.10^{bc}	9.190^e	30.4^a	3.893^e	8.950^c	36.97^e	24.88^a
40%	90.52^{ab}	9.870^{ab}	27.8^b	4.353^c	9.177^b	42.55^c	23.67^b
50%	90.66^a	9.720b^c	24.5^d	4.193^d	8.230^e	33.45^f	21.23^d
CV (%)	0.29	0.85	0.41	1.62	0.68	1.70	0.40
Level of Significance	*	**	**	**	**	**	**
LSD (0.05)	0.4744	0.1522	0.1908	0.1409	0.1151	1.317	0.1627

Means followed by same letter significantly different at 1% or 5% level of significance.
^{NS} Not significant * Significant at 5% level; ** Significant at 1% level.

3.13.1. Moisture Content

The moisture content of the fruiting body shows significant difference. The moisture percent ranged from 89.85% to 90.66%. The highest moisture percent was observed in treatment 50% (90.66%) and lowest in 10% (89.85%). The moisture content of oyster mushroom was grown from 87 to 87.5% on different substrates.

3.13.2. Dry Matter Content

The dry matter percentage of the fruiting body shows significant difference. The highest dry matter was observed in 20% (10.02 %) and lowest in 30% (9.190 %). There are no significant differences among the treatments when cow dung used as supplement.

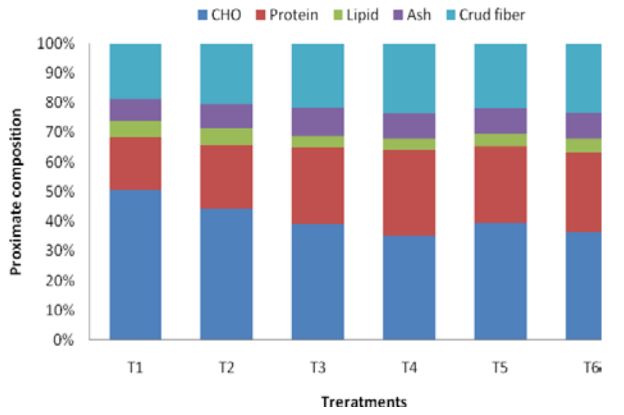

Figure 2. Effect of wheat bran supplements with sugarcane bagasse on the approximate composition of pink oyster mushroom (Dry weight basis)

3.13.3. Protein Content

The content of protein varied from 19.44 from 30.46% (w/w) in the mushroom grown on sugarcane bagasse with different levels of wheat bran. The highest content of protein was found in treatment 30% (30.46 %) and lowest in 0% (19.44 %). The protein content of oyster mushroom was 27.2% on an average.

3.13.4. Lipid Content

The lowest lipid percentage was accounted for treatment 20% (3.58 %) and highest in 10% (6.34 %). The result of the present study showed that the lipid content of the mushroom decreased as the supplements added with the substrates.

3.13.5. Ash Content

The highest percentage of ash was observed in the treatment 20% (9.51) and lowest in 0% (7.89). The range of ash content was 8.28 to 9.02% in *Pleurotus spp.* In the present study the ash content is as high as 12.80 might be due to the newly introduced varieties.

3.13.6. Carbohydrate Content

The lowest percentage of carbohydrate was counted under treatment 50% (33.45) and the highest in 0% (54.70). Related rresearch showed that carbohydrates content varies from 39.82 to 42.83% of in *Pleurotus spp [20]*.

3.13.7. Crude Fiber Content

The highest percentage of crude fiber was found in 30% (24.88) and lowest in 0% (20.24). The findings of this present study is similar to other findings ranging from 22.87g/100g to 23.29g/100g of fiber in *Pleurotus spp [20]*.

3.14. Effect on Elemental Content

3.14.1. Nitrogen Content

The highest percentage of nitrogen content (g/100gm) was counted under treatment 50% (4.99) and lowest nitrogen in 0% (3.59). The rest of the treatments were statistically similar in respect to percent nitrogen content. The findings of the present study match with other research that analyzed for various nutritional parameters and found that the range was 4.22 to 5.59 % of nitrogen on dry matter basis in fruiting bodies of oyster mushroom [21].

3.14.2. Phosphorus Content

The highest percentage of phosphorus content (g/mg/100gm) was counted under treatment 50% (1.077). The rest of the treatments were statistically similar but the lowest in 30% (0.913). But research found 0.97% phosphorus, in oyster mushroom grown on sugarcane bagasse based substrates [11].

3.14.3. Potassium Content

The highest proportion of potassium content (g/100gm) was counted under treatment 40% (1.567) and lowest 0% (1.190). On the other hand literature shows that 1.3% potassium found in oyster mushroom grown on sawdust based substrates [11].

3.14.4. Calcium Content

The maximum percentage of calcium content (mg/100g) was counted under treatment 20% (23.54) and in 40% (21.19). The findings of the present study match with the study that found 22.15 to 33.7 mg/100g of calcium in different oyster mushroom varieties [20].

3.14.5. Magnesium Content

The highest percentage of magnesium content (mg/100g) was counted under treatment 20% (21.05) and lowest in 0% (18.45). The rest of the treatments were statistically similar but differed significantly over control in respect to percent magnesium content. Literature shows that 13.4 to 20.22 mg/100g of magnesium in different oyster mushroom varieties [19]. (2).

3.14.6. Sulfur Content

There was no statistical difference among the treatments in terms of percent sulfur content. But the highest percentage of sulfur was counted under treatment 30% (0.04300) and the lowest in 0% (0.02300).

3.14.7. Iron Content

The maximum percentage of iron content (g/100g) was counted under treatment 50% (43.58) and lowest in 0% (40.52). 33.45 to 43.2 mg/100g of iron are found in different oyster mushroom varieties in other research [20].

3.14.8. Zinc Content

The highest percentage of zinc content (g/100g) was counted under treatment 20% (16.98) and lowest iron in 30% (14.45). This was more or less similar to other studies [20]. A comparison of the results can be retrieved from Table 6.

3.15. Correlation Study

A significant and positive correlation between average number of fruiting body and biological yield was observed when wheat bran was supplemented with sugarcane bagasse (Figure 3). The relationship showed a quadratic equation as $y = 3.223x+48.75$ ($R^2 = 0.143^{**}$). Where y = biological yield and x = average number of fruiting body. The majority of total variation in biological yield of the oyster mushroom can be explained by this equation. The R^2 value indicated that 14.30% of biological yield of Pink oyster mushroom (*Pleurotus djamor)* was attributed to the average number of fruiting body.

Table 6. Effect of different levels of wheat bran with sugarcane bagassee on elemental contents of pink oyster mushroom

Treatments	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)	Fe (%)	Zn (%)
0%	3.59[d]	0.95[bc]	1.19[d]	21.24[e]	19.29[d]	0.023[a]	40.52[d]	14.75 [d]
10%	4.23[c]	1.07[a]	1.55[a]	23.08[b]	18.45[e]	0.032 [a]	42.30[b]	16.55 [b]
20%	4.56[b]	1.01[ab]	1.39[c]	23.54[a]	21.05[a]	0.030 [a]	43.57[a]	16.98 [a]
30%	4.07[c]	0.91[c]	1.44[bc]	22.15[d]	20.24[b]	0.043 [a]	41.54[c]	14.45 [e]
40%	4.85[a]	1.04[a]	1.56[a]	21.19[e]	19.44[c]	0.035 [a]	42.19[b]	15.56 [c]
(50%)	4.99[a]	1.07[a]	1.51[ab]	22.78[c]	20.34[b]	0.025 [a]	43.58[a]	14.65 [de]
CV (%)	2.36	3.95	3.83	0.19	0.38	7.15	0.33	0.87
Level of Significance	**	**	**	**	**	**	**	**
LSD (0.05)	0.1908	0.08136	0.09965	0.08136	0.1409	0.05753	0.2508	0.2441

Means followed by same letter significantly different at 1% or 5% level of significance.
[NS] Not significant * Significant at 5% level; ** Significant at 1% level.

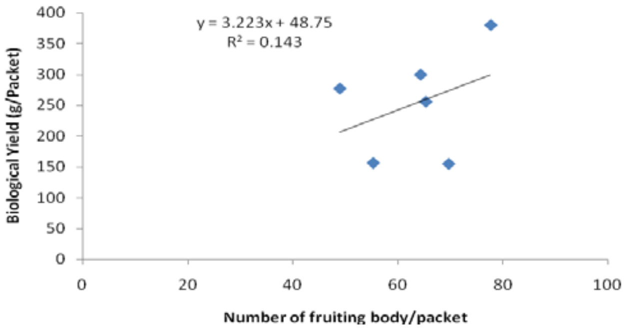

Figure 3. Relationship between average numbers of fruiting body with biological yield as influenced by different levels of wheat bran supplemented with sugarcane bagasse

A highly significant and correlation between average weight of individual fruiting body and economic yield was observed when wheat bran was supplemented with sugarcane bagasse (Figure 4). The relationship between average weight of individual fruiting body and economic yield could be expressed by the equation $y = 32.79x + 122.6$ ($R^2 = 0.188$*) where y = economic yield and x = average weight of individual fruiting body. The R^2 value indicated that 18.80% of economic yield of pink oyster mushroom (*Pleurotus djamor*) was attributed to the average weight of individual fruiting body.

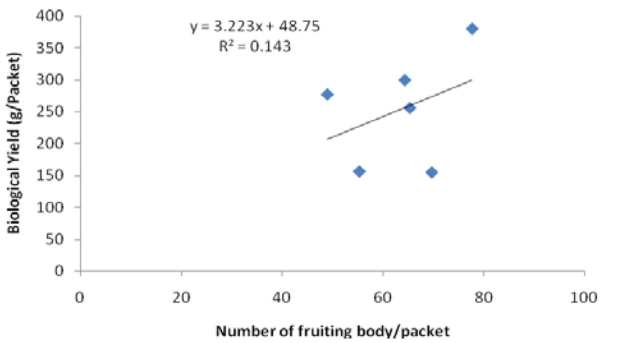

Figure 4. Relationship between average numbers of fruiting body with biological yield as influenced by different levels of wheat bran supplemented with sugarcane bagasse

4. Conclusion

The effect of 10% wheat bran as supplement with sugarcane bagasse were higher on growth, yield, biological efficiency and benefit cost ratio (BCR) of pink oyster mushroom (*Pleurotus djamor*) that required shorter days to full colonization as compared to the other treatments . It also proved to be better in terms mycelial running rate, length of stipe, average weight of individual fruiting body as well as average number of primordia and fruiting body. Sugarcane bagasse as supplement with wheat bran also had a great effect on proximate composition and mineral content of *Pleurotus djamor.* In this experiment more than one treatment performed better in case of benefit cost ratio. Therefore, 10% wheat bran supplemented with sugarcane bagasse can be recommended to pink oyster mushroom growers. In addition, it will be an economically effective due to highest yield and abundant availability throughout the year.

References

[1] Chang, S.T. and Miles, P.G. (1988). Edible Mushroom and their cultivation. CRC Press, Inc. Boca Raton, Florida U.S.A. pp. 27, 83, 88.

[2] Banik, S. and Nandi, R. (2004). Effect of supplementation of rice straw with biogas residual slurry manure on the yield, protein and mineral contents of oyster mushroom. *Industrial Crops and Products.* 20(3): 311-319.

[3] Amin, M.A. (2004). Studies on mycelium, spawn and production of certain edible mushrooms. M.S. Thesis, Department of Biotechnology, BAU, Mymensingh.

[4] Wikipedia (The free encyclopedia). (2015). *Pleurotus djamor*. Available from https://en.wikipedia.org/wiki/Pleurotus_djamor.

[5] Shah, Z. A., M. Ashraf and M. Ishtiaq. (2004). Comparative Study on Cultivation and Yield Performance of Oyster Mushroom (*Pleurotus ostreatus*) on Different Substrates (Wheat Straw, Leaves, Saw Dust). *Pakistan Journal of Nutrition* 3 (3): 158-160.

[6] Anderson, J. W. and Ward, K. (1979). High Carbohydrate high fiber diets for insulin- treated man with diabetes mellitus. *American Journal of Clinical Nutrition* 32:2313.

[7] Rahman, M.H., Ahmed,K.U., Roy,T.S., Shelly, N. J. and Rahman, M. S.(2012). Effect of wheat bran supplements with rice straw on the proximate composition of oyster mushroom (*Pleurotus ostreatus*). *Bangladesh research publications journal* 7(4): 306-311.

[8] Chandha, K.L. and Sharma, S.R. (1995). Advances in Horticulture. Mushroom, Malhotra Publication house, New Delhi.13: 649.

[9] Alam, S. M. and R. Saboohi. (2001). Importance of mushroom. Available from http://www.mushroomworld.com.

[10] Klingman, A.M. (1950). Hand book of mushroom culture. CRC Publishing co. J. B. Kenneth Square, Pennsylvania, USA.

[11] Sarker, N.C., Hossain, M.M.,Sultana, N., Mian, I.H., Karim, A.J.M.S. and Amin, S.M.R. (2007). Impact of different Substrates on Nutrient Content of *Pleurotus ostreatus* (Jacquin ex Fr.) Kummer. *Bangladesh Journal of Mushroom.* 1(2): 35-38.

[12] Zadrazil, F., & Brunnert, F. (1981). Investigation of physical parameters important for the solid state fermentation of straw by white rot fungi. *European Journal of Applied. Microbiology and Biotechnol.*, 11, 183-188.

[13] Oei, P. (1996). *Mushroom cultivation*. Tool Publications, Leiden, The Netherlands.

[14] Siddiqui, M. A., & Khan, S. M. (1989). Some studies on the cultivation of oyster mushroom (Pleurotus spp.) on ligno-

cellulosic by-products of textile industry. *Proceedings of the 12th International Congress on the Science and Cultivation of Edible Fungi* (pp.121-128). Braunschweig, Germany.

[15] AOAC. (1990). Official Methods of Analysis. 15th ed., Association of Official Analytical Chemists, Artington, Virginia, USA.

[16] Salma, I. J., Sajib, M. A. M., Motalab, M., Mumtaz, B., Jahan, S., Hoque, M. M., Saha, B. K. (2015). Comparative Evaluation of Macro and Micro-Nutrient Element and Heavy Metal Contents of Commercial Fruit Juices Available in Bangladesh. *American Journal of Food and Nutrition 3(2):56-63.*

[17] Sajib, M. A. M., Jahan, S., Islam, M. Z., Khan, T. A. and Saha, B. K. (2014). Nutritional evaluation and heavy metals content of selected tropical fruits in Bangladesh. *International Food Research Journal* 21(2): 609-615.

[18] Sajib, M. A. M., Hoque, M. M., Yeasmin, S. and Khatun, M. H. A. (2014). Minerals and heavy metals concentration in selected tropical fruits of Bangladesh. *International Food Research Journal*, 21(5): 1731-1736.

[19] Bhuyan, M. H. M. B. U. (2008). Study on Preparation of Low Cost Spawn Packets for the Production of Oyster Mushroom (Pleurotus Ostreatus) and its Proximate Analysis. M.S. Thesis, Department of Biochemistry, SAU, Dhaka-1207.

[20] Alam, N., Khan, A., Hossain, M.S., Amin S.M.R. and Khan, L.A. (2007). Nutritional Analysis of dietary Mushroom *Pleurotus florida* Eger *and Pleurotus sajorcaj (*Fr.) Singer. *Bangladesh Journal of Mushroom*. 1(2): 1-7.

[21] Moni, K. H., Ramabardan, R. and Eswaran, A. (2004). Studies on some physiological, cultural and post harvest aspects of Oyster mushroom *Pleurotus ostreatus* (Berk). *Trop. Agril. Res.* 12: 360-374.