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Comparative Analysis of Temperature on Yield of Different Varieties of Oyster Mushroom Production

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A B S T R A C T

Oyster mushrooms are economical and most easily grown of all cultivated edible mushrooms. The crop has a range of varieties, differing in form, colour, texture and odor, which can be cultivated throughout the year under a diverse agro-climatic conditions. Three different oyster mushroom species viz., *Hypsizygus ulmarius* (*var.* CO_2), *Pleurotus eous* (var. APK1) and *Pleurotus florida* (var. PF) along with three cropping rooms of varied temperatures was used for the study. Among the different cropping rooms, thatched shed with a temperature of 23^{o} C recorded a highest yield of 748g, 712 and 673 g per 500 g of substrate by PF, CO 2 and APK 1 respectively than AC room and Concrete room. The temperature of the cropping room is inversely proportional to the yield of oyster mushroom. Hence, the thatched shed was best suited for oyster mushroom cultivation, which was both economic and easy to use.

Keywords

AC room, Concrete room, Oyster mushroom, Temperature, Thatched shed

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Introduction

Oyster mushroom (*Pleurotus spp*.) is one of a common edible mushroom and was cultivated first during World War I in Germany as a remedial measure. Now these oyster mushrooms are cultivated commercially around the world for food, as they have excellent flavor and taste (Shah *et al.*, 2004). Oyster mushrooms are the third largest cultivated mushroom. China, the world leader in Oyster production, contributes nearly 85% of the total world production of about a million tonnes. The other countries producing oyster mushrooms include Korea, Japan, Italy, Taiwan, Thailand and Phillipines. The present production of this crop in India is only around 1500 tonnes due to low domestic demand. The oyster mushrooms (*Pleurotus* spp.) are in the third place after the white button and shiitake

among the world mush-room production (Moonmoon, *et al.,* 2010).

Oyster mushrooms are economical and most easily grown of all cultivated edible mushrooms. The crop has a range of varieties, differing in form, colour, texture and odor, which can be cultivated throughout the year under a diverse agro-climatic conditions.

The fruit bodies of this mushroom are distinctly shell or spatula shaped with different shades of white, cream, grey, yellow, pink or light brown depending upon the species.

These mushrooms are a strong source of non-starchy carbohydrate, dietary fiber and a modest level of protein including certain amino acids, vitamins and minerals. It contains 1.6 to 2.5 per cent more protein than any vegetables (Croan, 2004). These species are rich in 56.01% carbohydrates, 19.64% protein, 5.45% crude fibre, 1.36% fat, calcium 455mg/100g, iron 8.4 mg/100g with total calorific value of 314.96 kcalories/100g and antioxidant activity of 1.18 mg/g. The Oyster mushroom has been found to be ideal for people suffering from anemia, hyperacidity, and constipation.

Oyster mushroom cultivation depends upon various factors. The suited conditions for oyster mushroom cultivation 20 to 30°C temperature and 55-70% humidity (Ahmed *et al.,* 2013). It can also be cultivated in summer months by providing the extra humidity required for its growth. Rapid growth rate and early harvesting are evidenced. Approximately 5 to 6 crops will be taken per year as the average cropping time is 60 days. Among different factors,

Temperature is an important factor which have a direct impact on yield of mushroom, as the growth of mycelium and fruiting bodies is dependent of temperature. Even a slight increase in the optimum temperature can have a serious impact on the yield of the oyster mushrooms. The mushroom can be cultivated indoor on different ways but with suited temperature. With this aim, a comparative evaluation on yield of three different oyster mushroom species viz., *Hypsizygus ulmarius (var.* CO_2), *Pleurotus eous* (var. APK1), *Pleurotus florida* (var. PF) have been conducted on three different cultivation room with varied temperatures utilizing paddy straw as substrate and the results are discussed.

Materials and Methods

The current evaluation was carried out from January 2020 to March 2020 in the Mushroom Production unit, Department of Plant Protection of Anbil Dharmalingam Agricultural college and Research Institute, Tiruchirapalli. The descriptions of the experimental tools used and the techniques adopted during the investigations were clearly described in this chapter.

Substrate preparation

Dry paddy straw used as substrate was cut into small pieces of 3-5 cm and thoroughly soaked in potable water for 5 hrs. After draining the excess water, the substrate was dipped in boiling water maintained at 80^0C for 60 min. The partially sterilized straw bits were shade dried until the moisture content of the substrate was 60 per cent and used for spawning (Srivastava and Bano, 2010).

Bed preparation

Polypropylene bags (100 G thickness) measuring 60 x 30 cm sizes were used as containers for the pretreated paddy straw substrate. For each the bag 500 g of substrate (dry weight basis) was used. Three cylindrical beds for each variety of oyster mushroom was prepared using layer method.

Cultivation room

Thatched shed

Here thatched shed was made using coconut leaves was used. The temperature of the shed was 23 ^{o} C with 70 % of humidity. Water is sprinkled to maintain the temperature.

Concrete Room

A room made of concrete was used for cultivation. Here the mushroom was cultivated on room temperature during the entire growing period. The Temperature observed was 28-29^{o} C with 75 % humidity.

Air-conditioned room

A room made of concrete was used for cultivation as above, but the room temperature was controlled by the use of air conditioner. The temperature of 25^{o} C was set up on the air conditioner during the entire growth period.

All the cropping room consists of 3 beds of each variety with a total of 9 beds. The beds were placed in hanging rope system on each cropping room.

The mushroom varieties *Pleurotus florida* (var. PF), *Pleurotus eous* (var. APK1) and *Hypsizygus ulmarius* (var. CO2) was harvested three times, weighed and recorded. Then, the observations on yield characters like days for spawn run (DFSR), days for pinhead formation (DFPF), days for first harvest (DFFH) and total yield (g per 500g substrate) were recorded. The bio-efficiency percentage was calculated and tabulated.

Results and Discussion

The results showed that for spawn running the variety PF took 16.8, 17.0 and 17.5 days and variety CO2 took 18.6, 18.7 and 19.3 days and the variety APK 1 took 10.7, 10.8 and 11.1 days on Thatched shed, AC Room and Concrete room respectively. Similarly, PF took 25.0, 25.2 and 26.0 days, CO 2 took 24.9, 25.2 and 25.9 days and APK 1 took 15.8, 16.0 and 16.5 days for first harvest of mushroom respectively on Thatched shed, AC Room and Concrete room (Table 1.). From the table it can be cleared that the mycelial growth was faster and earlier in all three varieties on the thatched shed and AC room than the Concrete room. The reason is because the temperature of the thatched shed and AC room was low compared to the Concrete room. Hence the concrete room showed a mycelial growth with the delay of 1-2 days.

It can also be observed that the DFSR was earlier on *Pleurotus eous* (var. APK1), having earlier harvest with the total life cycle of 38-40 days. *Hypsizygus ulmarius* (var. CO2) completed its within 42 days and *Pleurotus florida* (var. PF) variety took 48-50 days to complete the life cycle.

Pleurotus florida (var. PF) - The yield of PF variety was high with 748 g per 500 g of substrate on thatched shed, followed by AC room yielding 696 g per 500 g of substrate in average. The yield was very low in concrete room producing an average of 625 g of mushroom per 500 g of substrate.

Hypsizygus ulmarius (var. CO2) – Similarly, the yield was high on thatched shed with 712 g per 500 g of substrate, followed by AC room producing 644 g per 500 g of substrate on average. The concrete room produced a lower yield of 607 g of mushroom per 500 g of substrate. *Pleurotus eous* (var. APK1) - thatched shed recorded the maximum yield of 673 g per 500 g of substrate, followed by AC room producing 586 g per 500 g of substrate on average. The concrete room with the least yield of 532 g of mushroom per 500 g of substrate.

Table.1 Comparison of DFSR, DFPF and DFFH of three varieties of oyster mushroom under different cropping room

Variety	Data	Thatched Shed	AC Room	Concrete Room
PF	**DFSR**	16.8	17.0	17.5
	DFPF	22.2	22.4	23.0
	DFFH	25.0	25.2	26.0
CO2	**DFSR**	18.6	18.7	19.3
	DFPF	22.7	22.9	23.6
	DFFH	24.9	25.2	25.9
APK 1	**DFSR**	10.7	10.8	11.1
	DFPF	13.1	13.2	13.6
	DFFH	15.8	16.0	16.5

Table.2 Yield of *Pleurotus florida* (var. PF) under different cropping room

Yield (g/500g)	AC Room			Thatched Shed			Concrete Room		
PF	**Bag 1**	**Bag 2**	**Bag 3**	**Bag 1**	**Bag 2**	**Bag 3**	**Bag 1**	**Bag 2**	**Bag 3**
I Harvest	405	404	387	380	371	362	333	343	324
II Harvest	253	257	235	237	236	220	208	218	197
III Harvest	101	74	130	95	67	122	83	62	109
Total	**760**	**735**	**751**	**712**	**674**	**704**	**624**	**623**	**629**

Table.3 Yield of *Hypsizygus ulmarius* (var. CO2) under different cropping room

Yield (g/500g)	AC Room			Thatched Shed			Concrete Room		
CO2	**Bag 1**	**Bag 2**	**Bag 3**	**Bag 1**	**Bag 2**	**Bag 3**	**Bag 1**	**Bag 2**	**Bag 3**
I Harvest	405	416	436	367	372	398	335	337	363
II Harvest	202	201	157	183	179	143	168	163	131
III Harvest	101	100	118	92	90	107	84	81	98
Total	**708**	**717**	**711**	**642**	**641**	**648**	**587**	**581**	**592**

Table.4 Yield of *Pleurotus eous* (var. APK1) under different cropping room

Yield (g/500g)	AC Room			Thatched Shed			Concrete Room		
APK 1	**Bag 1**	**Bag 2**	**Bag 3**	**Bag 1**	**Bag 2**	**Bag 3**	**Bag 1**	**Bag 2**	**Bag 3**
I Harvest	348	346	313	314	311	285	274	273	249
II Harvest	219	203	214	197	183	194	172	161	170
III Harvest	105	129	142	94	116	129	82	102	113
Total	**672**	**678**	**669**	**605**	**610**	**608**	**528**	**536**	**532**

Table.5 Mean Yield and bio-efficiency of three varieties under different cropping room

	AC Room		Thatched Shed		Concrete Room	
	Yield (g/500g)	**BE %**	**Yield (g/500g)**	**BE %**	**Yield (g/500g)**	**BE %**
PF	748	149.6	696	139.2	625	125
CO 2	712	142.4	644	128.8	586	117.2
APK 1	673	134.6	607	121.4	532	106.4

Fig.1

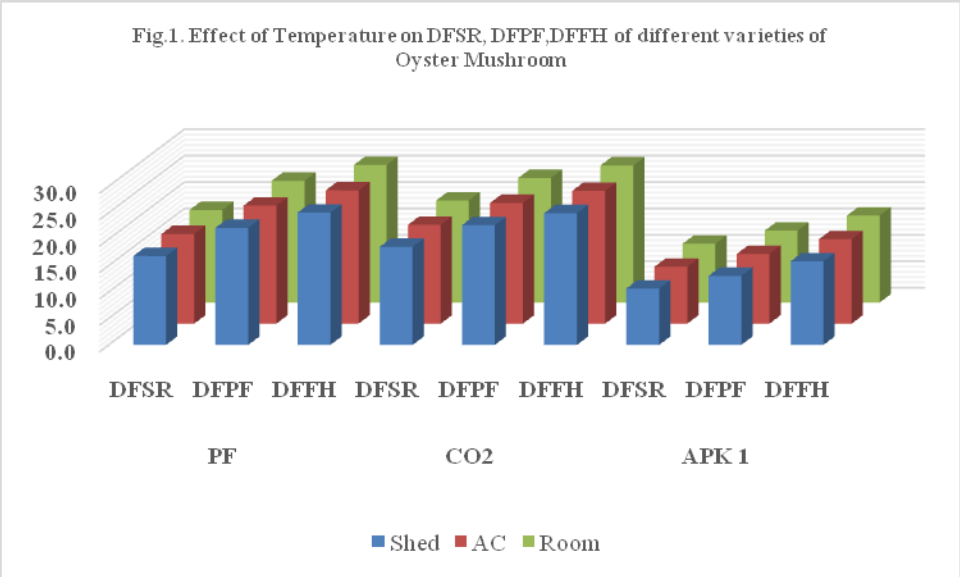
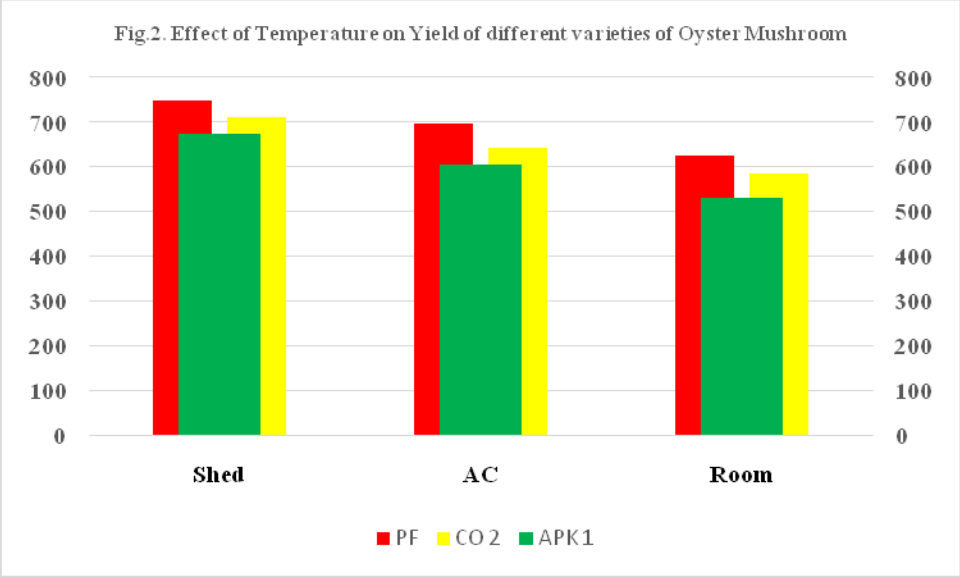


Fig.2



From the table (5.), it was clearly understood that all the three varieties had their maximum yield on the thatched shed than the other two cultivation rooms. Also concrete room recorded the lower most yield irrespective of the varieties. This is due to the fact that the growth of the mushroom was severely affected by the variation in temperatures of the cultivation room. The thatched shed as it had the lowest temperature produced a maximum yield and Concrete room with high temperature yielded low. Also among the varieties *Pleurotus florida* (var. PF) showed good performance on all the three conditions followed by *Hypsizygus ulmarius* (var. CO2) and *Pleurotus eous* (var. APK1).

Hence, it can be concluded that the thatched shed maintains low temperature and was very suitable for the cultivation of oyster mushroom. Also, increase in temperature will invariably cause a decrease in the yield of oyster mushroom irrespective of the varieties. This system was environmentally benign, cost effective and may be helpful to increased oyster mushroom production under Indian condition.

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