

Seasonal variation in contamination of spawn and yield of *Pleurotus sajor-caju* (Fr.) Singer in a commercial farm in coastal Karnataka

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ABSTRACT

Observation on contamination of *Pleurotus sajor-caju* spawn bottles in a commercial farm in Dakshina Kannada district of Karnataka in different seasons for two years revealed that contamination was the highest during monsoon season, followed by post-monsoon season. But the over-all success of spawn production was high (91.4%) in the commercial farm. The contamination of spawned bags was also highest during monsoon season. In spite of higher contamination, the yield was highest during monsoon season in all the three years of observation and lowest during pre-monsoon period. However, the yield of *P. sajor-caju*, obtained in the commercial farm was not very good.

Key words : Mushroom, *Pleurotus sajor-caju*, seasonal variation, cultivatin contamination, spawn.

Most of the reports on *Pleurotus* cultivation in India are based on small-scale trials and laboratory experiments. Proper scientific production technology for large-scale cultivation in different agro-climatic zones of the country is necessary to improve the production efficiency. A perusal of available literature indicates that the data on various aspects of large scale production of oyster mushroom in coastal Karnataka are not available. Hence, the present study was undertaken to find out the productivity in a commercial farm in Dakshina Kannada district of Karnataka State, following the cultivation procedures prevailing in other parts of the country.

MATERIALS AND METHODS

Pleurotus sajor-caju (Fr.) Singer culture was obtained from the University of Agricultural

Sciences, Bangalore and used as mother culture. Spawn was prepared in 500 ml capacity empty saline/glucose bottles containing sterilized sorghum grain.

(*Sorghum vulgare* Pers.) grains (300 g) were mixed with two per cent calcium carbonate on dry weight basis. The bottles inoculated with the mother culture were incubated at room temperature for 15 days and used as mother spawn. Uncontaminated mother spawn was used for mass multiplication of spawn.

Paddy straw procured locally, was chopped to a size of 5-10 cm and soaked in water for 16 h. After draining the excess water, the wet straw was pasteurized in steam chamber at 121°C for 25 min. The substrate was filled in high molecular high density polythene (HMHDP) bags of 55 x 40 cm

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size (100 gauge) @ 4 kg wet substrate per bag. Multilayer spawning technique was followed to inoculate the substrate. Spawn was added at a level of about three per cent of the substrate. Few pin holes were made at the bottom of the bag for drainage. The bags were incubated in the cropping room of the mushroom house for a spawn run period of 20 days. The exposed beds were sprayed with water daily once or twice depending on the season. Relative humidity inside the cropping room was maintained around 90%. A maximum of three flushes were taken from each bag during a cultivation period of about 50 days. All the fruiting bodies produced on a bed were harvested at the same time and no selective harvesting was practised.

Since large-scale spawn production was undertaken, the contamination of spawn bottles at monthly intervals was recorded for a period of two years, 1986-1988. Spawn bottles were examined during the two-week period of mycelial growth and the date and number of bottles inoculated during each month and number of spawn bottles showing fungal and bacterial contaminations were separately recorded. Based on the data recorded every month, the percentage of spawn bottles contaminated in different seasons viz., monsoon (June-September), Post-monsoon (October-January) and Pre-monsoon (February-May) was determined.

Observations on contamination of mushroom bags during spawn run period were recorded for three years. Data on the number of bags inoculated and the bags showing contamination of more than 85% area of the substrate were recorded at monthly intervals starting from June for three years.

To find out the seasonal effect and to identify the best season for mushroom cultivation in this region with the existing method of cultivation, yield

of fresh mushrooms was recorded for three years from 1984 to 1987. Total number of bags filled, the date of spawning, the date of harvest and the yield were recorded every month.

Maximum and minimum temperature in the cropping room were recorded through the cropping period using maximum and minimum thermometers. RH in the cropping room was recorded daily at a fixed time. In addition, the temperature, RH and rainfall data were obtained from the meteorological observatory of CPCRI Regional Station, Vittal, located six km away from the mushroom farm.

RESULTS AND DISCUSSION

The capacity utilization of mushroom farm during 1985-86 was 96.5% whereas it was 57.9 and 51.2% in 1984-85 and 1986-87 respectively. Therefore, the number of spawn bottles prepared and number of bags spawned also varied between the years. As the mushroom production was the highest in monsoon season, the grower took more interest in increasing the production during monsoon season. Therefore, the number of spawn bottles prepared as well as number of bags spawned also varied with the season.

The observations recorded for two years at monthly intervals were compiled and presented season-wise. The number of spawn bottles inoculated, number of bottles rejected due to bacterial and fungal contaminations and their percentage in three seasons viz., monsoon, post-monsoon and pre-monsoon are presented in table 1. A total of 20,092 bottles of spawn were prepared during the two-years of study, of which, 9,507 bottles of spawn were prepared during the monsoon seasons of two years.

Table 1 : Contamination of spawn bottles in different seasons in two years (1986 to 1988)

Season	Contamination of spawn bottles						Total	Percentage
	No. of bottles inoculated	Fungal		Bacterial				
		No. of bottles	Percentage	No. of bottles	Percentage			
Monsoon	9,507	554	5.8	368	3.9	922	9.7	
Post monsoon	8,003	340	4.2	334	4.2	674	8.4	
Pre monsoon	2,582	141	5.5	0	0	141	8.6	
Total	20,092	1,035	5.2	702	3.5	1,737	8.6	

The contamination was highest during monsoon season followed by post-monsoon season. Out of the 9,507 bottles of spawn prepared during monsoon season 554 and 368 bottles were found contaminated due to fungi and bacteria, respectively, But only 8.6% of the total bottles inoculated were rejected due to microbial contamination during the period of two years. The fungal contamination was more than bacterial contamination during all the three seasons. The congenial climatic conditions such as low temperature and high humidity during the monsoon season might have facilitated the increase of air spora of saprophytic fungi and thereby, increasing the chances of contamination. Fungal contamination a serious problem in spawn production³. Since the cultivator was following a standard technology, the over all success of spawn production in the large-scale production unit was high (91.4%).

The total number of bags spawned, number of bags with more than 85% surface area contaminated and the percentage contamination of bags during monsoon, post-monsoon seasons for three years from 1984-85 to 1986-87 are presented in Table 2. A total of 61,686 bags were filled during a period of three years. Of these, 8.5% bags were rejected due to microbial contamination. The contamination of mushroom bags varied between the years and the seasons. The per cent contamination of mushroom bags was the highest (12.73%) during 1985-86 irrespective of the seasons. The percentage of mushroom bags rejected due to contamination was 4.76 and 4.25 during 1984-85 and 1986-87, respectively, when the capacity utilization of mushroom farm was 57.9 and 51.2%, respectively. The high rate of contamination during 1985-86 might be attributed to the highest capacity utilization (96.5%).

The variation in contamination of mushroom bags varied between seasons of different years. During 1984-85 and 1986-87, the contamination was highest during monsoon season. However, the mushroom bags rejected due to contamination were highest during pre-monsoon period of 1985-86. The contamination of mushroom bags was influenced not only by the seasonal variation, but also by the capacity utilization of mushroom farm (number of bags spawned).

During the course of cultivation of *P. sajor-caju* on steam pasteurized and chemically sterilized wheat and paddy straw substrates, a large number of fungal competitors which adversely affect its yield have been reported by various workers^{2,7,8,9,10}. Studies on air-and substrate-borne weed fungi associated with *P. sajor-caju* cultivation at Bangalore, India, revealed that some of the fungi caused appreciable loss of crop⁶.

The mushroom yield was highest during monsoon season in all the three years, irrespective of the number of bags filled. Though the number of bags filled during the post-monsoon periods of three years was more than the monsoon season, the yield was less than monsoon season. The total number of bags spawned and total yield obtained during pre-monsoon periods of three years were much less than the other two seasons (Table 3).

The yield not only varied with the seasons, but also between years in the same season. The average yield per kg of substrate was highest during monsoon season in all the three years and lowest, during pre-monsoon season. The average yield of mushroom was the highest in 1986-87 in all the three seasons compared to the previous two years. Monsoon season starting from June to October was found to be the best season for the cultivation of *P. sajor-caju* on paddy straw in Dakshina Kannada district of Karnataka State, India.

During the three years, mean temperature varied from 25.5° to 27.0° in the observatory, whereas it was 26.0° to 29.0° in the cropping room. The maximum temperature in the meteorological observatory (27.9° to 31.0°C) and cropping room (27.3° to 31°C) did not vary during monsoon season. The minimum temperature was higher in the cropping room than the observatory. It varied from 22.3° to 23.2°C and 24.2° to 27.3°C in the meteorological observatory and the cropping room, respectively. The RH in the observatory varied from 70.6 to 96.6% with a mean of 82.6 to 90.0%. The RH in the cropping room was maintained above 90% (94-98%).

During the post-monsoon seasons of three years, mean temperature varied from 26.3° to 27.5° in the observatory, whereas it was 24.2° to 28.9°C in the cropping room. The maximum temperature

Table 2 : Seasonal variation in contamination of mushroom bags (beds)

Season	1984-85				1985-86				1986-87				Total of three years												
	Bags spawned		Bags rejected		Bags spawned		Bags rejected		Bags spawned		Bags Rejected		Bags spawned		Bags rejected										
	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)									
Monsoon	8,371	508	6.1	11,762	1,586	13.5	5,861	477	8.1	25,994	2,571	9.9	8,071	319	3.9	13,052	1,343	10.3	7,645	139	1.8	28,768	1,801	6.3	
Post monsoon	941	75	7.9	4,129	758	18.4	1,854	37	1.9	6,924	870	12.6	17,383	902	4.76	28,943	3,687	12.73	15,360	653	4.25	61,686	5,242	8.5	
Total																									

Table 3 : Seasonal variation in yield of *P. sajor-caju* cultivated on paddy straw

Season	1984-1985				1985-1986				1986-1987				Total of three Years													
	Bags spawned		BE		Bags spawned		BE		Bags spawned		BE		Bags spawned		BE											
	(No.)	Yield (kg)	(%)	(kg)	(No.)	Yield (kg)	(%)	(kg)	(No.)	Yield (kg)	(%)	(kg)	(No.)	Yield (kg)	(%)	(kg)										
Monsoon	8,371	2,022.90	20.2	1,983.95	11,762	1,983.95	13.9	5,861	2,180.8	31.0	25,994	6,187.65	19.8	8,071	547.87	5.7	13,052	1,964.85	12.6	7,645	1,464.3	16.0	28,768	3,977.02	11.5	
Post monsoon	941	15.75	1.3	265.55	4,129	265.55	5.3	1,854	353.2	15.8	6,924	634.45	7.6	17,383	2,586.52	12.4	28,943	4,214.35	12.1	15,360	3,998.3	21.7	61,686	10,799.12	14.6	
Total																										

Average dry weight of substrate per bag : 1,200 g

in the cropping room (25.2° to 32.8°C) was lower than that in the meteorological observatory (30.9° to 34.2° C). But the minimum temperature in the cropping (23.0° to 27.4°) was higher than that in the observatory (19.1° to 23.4°).

The RH in the observatory varied 40.1 to 95.1% with a mean of 65.5 - 82.8%. The RH in the cropping room was maintained above 85% (85-95%).

During the pre-monsoon season of three years, mean temperature in the observatory (26.9° to 30.6°C) and cropping room (26.1° to 31.7°C) did not vary much. The maximum temperature in the cropping room (29.1° to 34.2°) was lower than that in the observatory (33.6° to 36.2°C). As observed in the other two seasons, the minimum temperature in the cropping room (23.1° to 29.2°C) was higher than that in the observatory (19.4° to 24.9°C). The RH in the observatory varied from 44.6 to 94.5% with a mean of 68.9 to 75.2%. The RH in the cropping room was maintained above 85% (85.5 to 89%).

The total rainfall was 3532mm, 3056mm and 2986mm during 1984-85, 1985-86 and 1986-87 respectively. The number of rainy days was highest in the month of June during 1985-86 and 1986-87 and in the month of July during 1984-85. The maximum rainfall was in the month of June in all the three years. There was no rainfall during December to March and January to May during 1984-85 and 1986-87, respectively and January, February and April months of 1984-85.

The mushroom yield and climatic data recorded for a period of three years during the present study indicated that the average yield per bag was highest during monsoon period and the lowest during pre-monsoon period. During monsoon season, RH was above 90% and the temperature ranged from 24° to 30°C. Presence of rainfall, high RH and low temperature appeared to be the favourable factors responsible for the higher yield during monsoon, in spite of the high rate of contamination of beds during this season. The pre-monsoon season (February to May) was the hottest in the place of study. Though the RH during this period was more than 90%, the maximum and minimum temperatures were around 33°C and 26°C, respectively. It may be inferred from these

results that high temperature, (both minimum and the maximum during pre-monsoon period) is unfavourable for *P. sajor-caju* cultivation, which resulted in poor mushroom yield. During post-monsoon period (October to January), though the night temperature was low, the day temperature was more than that of the monsoon season. The higher day temperature and low RH during post-monsoon period also appeared to be unfavourable climatic factors affecting the yield during the post-monsoon period. Similar higher yield of *P. sajor-caju* during monsoon season at Mysore has been reported¹. Experiments on the performance of different *Pleurotus* species in different months at Coimbatore revealed that *P. sajor-caju* could perform well in all the months except during March, April and May. Peak performance of this species could be noticed during September-January. Based on further observations on the performance of different species of *Pleurotus* in different localities, the need to test all the available *Pleurotus* species in different agroclimatic zones has been suggested⁵. The present studies on the performance of *P. sajor-caju* cultivated in the commercial farm following the prevailing method of cultivation revealed that the yield was very poor during all the three years of cultivation. The overall BE of 14.6% achieved during the three years was much inferior to that reported from other places^{1,4}.

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