

Cultivation of *Pleurotus sajor-caju* (Fr.) Singer on areca wastes – standardization of substrate preparation during summer and rainy seasons

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ABSTRACT

Fallen areca leaves, areca bunch waste and dried arecanut husk are the major by-products of areca cultivation, which are available in large quantities in the areca growing areas of India. Studies were conducted to standardize the method of pasteurization of these substrates for *Pleurotus sajor-caju* cultivation during summer and rainy seasons. The average yield of fresh mushrooms obtained in 3 flushes on areca leaf sheath and areca bunch waste was the highest in the treatment formalin 500 ppm+carbendazim 25 ppm in both summer and rainy seasons. The average yield on leaf sheath was 325.7g (BE 40.46%) and 651g (BE 69.75%) and on areca bunch waste it was 524g (BE 56.17%) and 594g (BE 61.53%) during summer and rainy seasons respectively. The yield was highest in the treatment formalin 500ppm + carbendazim 12.5ppm when areca whole leaf (leaf along with sheath) was used as substrate. The cultivation period varied with the seasons. Thus, chemical sterilization technique has been found to be an ideal and suitable method of substrate preparation. The yield obtained on arecanut husk was very poor in all the treatments tried.

Keywords: *Pleurotus*, areca wastes, chemical sterilization, mushrooms, oyster mushroom, cultivation

Success of oyster mushroom cultivation in any locality depends on the substrates, which are cheap and easily available as well as viable technology suitable for a particular agro-climatic region. Paddy straw is the popular substrate for *Pleurotus* cultivation in many parts of South India. Among the many species of *Pleurotus*, *P. sajor-caju* has been reported to be the ideal species for cultivation on paddy straw in coastal Karnataka⁵. The area under paddy cultivation is drastically decreasing year by year and its straw is very costly, especially in coastal Karnataka. On the other hand, area under areca cultivation is increasing even in non-traditional areas. Owing to the high remunerative price of arecanut, farmers are converting paddy fields in to areca garden. It was therefore thought of importance to try areca wastes for oyster mushroom cultivation. Fallen areca leaf, areca bunch waste and areca nut

husk are the major by-products of areca cultivation, which are available in large quantity in the areca growing regions. But these areca wastes have not been so far put into any proper use. The preliminary studies on the feasibility of using areca leaf sheath^{2,3} and areca bunch waste⁴ for *P. sajor-caju* cultivation have revealed that these can be used as substrates for *Pleurotus* cultivation. Hence, the present study was undertaken to standardize the preparation of substrates - areca wastes for *P. sajor-caju* cultivation during summer and rainy seasons, the two main seasons in a year in coastal Karnataka.

MATERIALS AND METHODS

Areca leaf with sheath (whole leaf), leaf sheath alone, areca bunch waste (ABW) and arecanut husk

were evaluated as substrates for the cultivation of *Pleurotus sajor-caju* (Fr.) Singer. For this, dried areca leaves were chopped to a length of about 5cm and leaf sheath to a size of 6cmx3cm. Naturally dried ABW was chopped into 4-5cm bits. Arecanut husk (Split into two halves) were used as such. Steam pasteurization and six treatments of chemical sterilization of each substrates were tried to select a suitable method of substrate preparation during summer (Jan-May) and rainy seasons (June-Sept) in coastal Karnataka. The substrates were pasteurized with steam at 121°C for 30min. after soaking in water for 18h. For chemical treatment of the substrate, different concentrations of carbendazim were tried, keeping the formalin concentration constant at 500ppm in all the treatments (Table 1).

Chopped substrates were filled in gunny bags @ 10kg/bag and the gunny bags were soaked in 100l chemical solution. After 18h of soaking, the gunny bags containing the substrates were taken out and excess water was allowed to drain out. Substrates without any additives were used for *P. sajor-caju* cultivation in both the seasons. Moisture content of the substrate at the time of spawning was determined.

Twenty days old sorghum [*Sorghum biocolor* (L) Moonch] grain spawn was used at the rate of 2% of wet weight of substrate. The substrate was filled in perforated high density high molecular polythene bags keeping the bed weight to be 3.5 kg after spawning. After spawning, the bags were incubated in dark at an ambient temperature of 24-28°C in partially underground permanent mushroom house. After a spawn run period of 15 days, the polythene bags were removed and the beds were transferred to the cropping room of the mushroom house. Water was sprayed to the beds to keep them wet. Relative humidity (RH) of the cropping room was maintained above 80%, Max. and min. temperature inside the mushroom house were recorded during the cultivation period. The mushroom fruiting bodies were harvested separately from each bed and fresh weight was recorded. Three flushes were harvested during the cropping period and biological efficiency (BE%) was calculated.

RESULTS AND DISCUSSIONS

The different treatments of substrate preparation and the performance of *P. sajor-caju* on four areca wastes are presented in Table 1.

Table 1: Cultivation of *Pleurotus sajor-caju* on differently treated Areca wastes, during summer and rainy seasons in coastal Karnataka.

S. No.	Treatments	Leaf sheath		Whole leaf		Bunch Waste		Nut-husk	
		S	R	S	R	S	R	S	R
1.	Steam pasteurization	18.3	11.8	11.7	3.7	9.5	4.9	1.1	-
2.	Formalin 500ppm alone	22.7	42.6	42.1	45.8	23.5	29.8	1.9	2.6
3.	Formalin 500 ppm + carbendazim 5ppm	29.3	46.3	48.3	45.0	29.7	32.5	5.1	2.5
4.	Formalin 500 ppm + carbendazim 12.5 ppm	35.6	56.3	60.7	65.5	28.8	56.3	5.7	2.9
5.	Formalin 500 ppm + carbendazim 25 ppm	40.5	69.7	57.8	46.0	56.2	61.5	7.1	2.5
6.	Formalin 500 ppm + carbendazim 37.5 ppm	39.1	61.9	55.5	30.9	44.8	58.3	8.3	2.9
7.	Formalin 500 ppm + carbendazim 50 ppm	38.0	59.9	50.1	22.6	20.2	41.5	6.7	4.0

Dry wt. of substrate per bag 805; S = Summer; R = Ring

The min. and max. temperature inside the partially underground mushroom house during summer season ranged from 22.0 to 27.5 and 28°C to 31.5°C respectively. During rainy season the min. and max. temperatures inside the mushroom house ranged from 24.0 to 26.0 and 27.0 to 30.0°C respectively.

Effect of different treatments of pasteurization of areca leaf sheath on yield of *P. sajor-caju* revealed that average yield of fresh mushroom was the highest in the treatment Formalin 500 ppm + carbendazim 25 ppm both summer and rainy seasons. Thus the mushroom yield varied between the seasons as well as with the treatments. From the initial studies on the cultivation of *P. sajor-caju* on leaf sheath, Chandramohanan³ reported that the average yield was 418g/bag containing 3.5kg of substrate during Aug-Oct. But there was no information on the method of substrate preparation suitable for summer and rainy seasons, the most unfavourable and favourable seasons in coastal Karnataka respectively for oyster mushroom cultivation.

Studies on the preparation of areca whole leaf for the cultivation of *P. sajor-caju* revealed that the yield was the highest in the treatment Formalin 500ppm + carbendazim 12.5ppm. But there was no uniformity in flushing pattern between the bags, when whole leaf was used as substrate.

In the present study, dried areca leaves were used as substrate. But, when steam pasteurized freshly fallen areca leaf (whole leaf) and leaf sheath alone were used without pre-soaking in water for *P. sajor-caju* cultivation the average yield of fresh mushroom per bag containing 4kg wet weight of substrate was 468g and 344g in leaf sheath and whole leaf respectively². Number of flushes harvested also varied very much (2-6) between beds. But when dried areca leaf with sheath and leaf sheath alone were used, the spawn run was faster. Here the no. of days from inoculum to first flush varied from 23 to 26 days and 21.-25 days in whole leaf and leaf sheath respectively during rainy season. The spawn run period did not vary with the season. The poor yield obtained in steam pasteurized dry areca leaf compared to freshly fallen leaves can be attributed to the high microbial contamination of the substrate. The population of microorganisms might have increased considerably during the period of drying and storage of the leaves.

Among the seven treatments tried for pasteurization of ABW, formalin 500ppm + carbendazim 25 ppm treatment gave the highest yield of mushrooms. Among the treatments, the lowest yield was obtained on all the four substrates with steam pasteurization. The yield obtained on areca leaf sheath, ABW and whole leaf was higher during rainy season, in the different chemical sterilization treatments. When leaf sheath, whole leaf and ABW were sterilized with formalin 500ppm alone, formalin 500ppm + carbendazim 5ppm and steam pasteurization, there was high rate of contamination of substrates due to high incidence of green moulds and *Coprinus* species which resulted in poor yield. The yield of *P. sajor-caju* obtained on arecanut husk was very poor (less than 100g) irrespective of the treatments tried. Spawn run was also very poor in all the treatments. There was very

Table-2 : Yield-pattern of *Pleurotus sajor-caju* on chemically sterilized areca wastes during summer (Feb-May) and rainy season (June-Sept.) in Karnataka

Flush	Summer Season			Rainy Season		
	WL	LS	ABW	WL	LS	ABW
I	230	130	121	233	217	222
II	267	156	213	92	108	167
III	49	39	169	270	326	224
Total Yield	546	325	503	595	651	613
B.E. (%)	60.1	40.5	54	65.5	69.7	63.4

WL : Whole leaf; LS: Leaf Sheath; ABW: Areca bunch waste

Substrate pasteurisation: Formalin 500 ppm + Carbendazim 12.5ppm (WL), 25 ppm (LS) and 25 ppm (ABW).

high incidence of weed moulds especially *Coprinus* species and green moulds on all beds irrespective of the treatments when husk was used as a substrate. Thus, it has been found that areca wastes except arecanut husk can be used for large scale cultivation of *P. sajor-caju*, after chemical sterilization.

The chemical sterilization of areca waste was found to be far better than steam pasteurization for the cultivation of *P. sajor-caju*, either for home cultivation or for commercial cultivation. Vijay and Rai⁷ reported that the yield of *P.sajor-caju* was the

highest on wheat straw treated with formalin 500 ppm + carbendazim 75ppm. the present study clearly indicates the scope for commercial cultivation of *Pleurotus* using areca wastes as substrates in the areca growing tracts of India. About 0.0822 million tonnes of dried arecanut bunch waste, 0.1317 million tonnes of dried areca leaf and 0.224 million tonnes of dry husks, are estimated to be available annually in India (Chandramohan R & Madhusudhanan, 1995).

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