

MUSHROOM CULTIVATION ON OIL PALM FACTORY WASTES

1. SCOPE FOR OYSTER AND PADDY STRAW MUSHROOMS

M. KOCHU BABU, K. RAMACHANDRAN NAIR and S. THANKACHY

Central Plantation Crops Research Institute, Research Centre, Palode, Pacha 695 562, Kerala

ABSTRACT

Two species of Oyster mushroom (*Pleurotus sajorcaju* and *P. florida*) and paddy straw mushroom (*Volvariella volvacea*) were evaluated on oil palm factory wastes viz., mesocarp waste and bunch refuse, by different methods. The highest yield on mesocarp waste was obtained in the case of *Pleurotus florida* (37.3% conversion). *Volvariella volvacea* recorded a conversion of 4.97% on bunch refuse. The scope for bio-utilization of these wastes by mushroom cultivation is discussed.

INTRODUCTION

The cultivation of Oil palm (*Elaeis guineensis* Jacq.), a potential oil yielder presently occupying about 5000 ha in India, is proposed to be extended to a few lakh hectares in the near future. A large quantity of factory wastes are available in an Oil Palm processing factory. Two main by-products obtained viz., Oil Palm Bunch Refuse (OPBR) and mesocarp waste (OPMW) are not put to economic use in India except as fuel for the boiler and as mulch in the plantations. These materials are used in paper industry in Malaysia (Muthurajah, 1983). With the objective of exploring the feasibility of utilizing these for mushroom cultivation, the scope of different tropical mushrooms was evaluated and the results are presented in this paper.

MATERIALS AND METHODS

Pure cultures of *Pleurotus sajorcaju* (Fr.) Singer, *P. florida* Eger (Oyster mushroom) and *Volvariella volvacea* Bull. ex Fr. Singer (Paddy straw mushroom) multiplied on Potato Dextrose agar were used for the trials.

Spawn: Paddy grains soaked overnight in water were boiled, mixed with Calcium Carbonate (2%) and filled in bottles. Pure cultures of the oyster mushroom were inoculated after sterilization of the bottles at 1.4 kg/cm².

Chopped paddy straw packed in bottles were

soaked overnight in water and excess moisture drained. Red gram powder was sprinkled in the bottle after making a hole in the centre of the straw. The bottles were sterilized at 1.4 kg/cm² for 1 hr and inoculated with cultures of *Volvariella volvacea*, using one-month-old spawn for the trials.

Preparation of Bed:

Mesocarp waste with seeds (2.5 kg) was soaked in two changes of cold water for 5 minutes to remove oil and squeezed to drain excess moisture. Polybags measuring 45 x 30 cm and 200 gauge thickness punched with holes were used. Mesocarp waste was placed in a 5 cm layer and sprinkled with spawn of *P. sajorcaju* and rice bran as starter. The poly-bag filled with the above was tied and hung in thatched mushroom sheds. The spawn rate was 4% and 8 replications were maintained. After 15 days of spawn run, the covers were removed and these mushroom beds were irrigated thrice daily. The yield in grams and number of mushrooms harvested were recorded.

Weighed bunch refuse soaked in water for 15 min. were arranged to form a layer on a raised platform in the thatched shed. Bits of paddy straw spawn were inoculated on the bunch refuse all around the layer. Red gram powder was dusted as the starter. Subsequently 2 to 3 similar layers were made in to bed sizes of 75 x 45 x 30 cm, 150 x 45 x 30 cm, and 150 x 45 x 45 cm. After placing the top layer, the bed was pressed down, compacted and covered with polythene sheet. The spawn used was at the

rate of one bottle for beds measuring 75 x 45 x 30 cm and two bottles for larger beds. Four replications were maintained. The beds were irrigated once in 4 days to keep moist. The polythene sheet was removed as soon as buds appeared and thereafter irrigated twice daily.

RESULTS AND DISCUSSION

The yield performance of Oyster mushroom is presented in Table I. The cropping period of *P. sajor-caju* was 5 weeks whereas that of *P. florida* extended to 8 weeks, although 90% of the crop was obtained in a period of 4 weeks. A mean yield of 933g and 705g could be obtained in *P. florida* and *P. sajor-caju* respectively from 2.5 kg of Oilpalm Mesocarp Waste (OPMW). Which works out to a conversion percentage of 37.5 and 28.2 respectively. The mean mushroom weight was higher in *P. florida*. One reason for the low production of *P. sajor-caju* might be high temperature during the cropping period (Average Max. 35.2°C). It generally prefers a temperature of 20-28°C (Chang and Quimio, 1982). The common contaminants were *Penicillium* sp. and *Trichoderma* sp.

This is the first report of cultivation of *P. florida* and *P. sajor-caju* on OPMW in India. Possibilities of utilizing OPMW independently and in combination with other substrates for the cultivation of Abalone mushroom (*P. cystidiosus*) was reported by Yong (1986).

However, he could get a conversion rate of only 21% with Abalone mushroom on OPMW.

The yield of paddy straw mushroom (*V. voluacea*) on OPBR presented in Table II. The mean yield of two layered beds of size 75 x 45 x 30 cm using one bottle of spawn was 1.4 kg. By doubling the spawn rate, substrate and bed size the yield increase was only about 70%. In 3-layered beds with 2 bottles of spawn the increase was 288% over the beds of size 75 x 45 x 30 cm. The mean mushroom weight and conversion percentage also increased. Sarkar and Chakravorthy (1986) reported a conversion rate of 10.5% on paddy straw. The use of OPBR for cultivation of *V. voluacea* (conversion rate = 3.5% in Malaysia was recorded by Naidu (1971).

From a factory with a capacity of 3 tons of FFB/hr, 0.45 tons of OPMW and 1 ton of OPBR are available. This free-sterilized substrate, therefore, should be preferred to other costly ones like paddy straw which has been proven to be the best so far for Oyster mushrooms (Chang and Quimio, 1982). Though conversion percentage in the case of OPBR was only 3-5%, in view of the substrate being a bulk waste and sterile, it is worth and profitable to substitute costly paddy straw.

Based on the prevailing labour cost (Rs. 35/day) and the cost of materials at Palode, the cost

Table I. Performance of Oyster mushrooms on oil palm mesocarp waste

Weeks after spawn run	Mean yield of mushrooms (g)		Mean weight of mushrooms (g)		Conversion percentage	
	<i>P. florida</i>	<i>P. sajor-caju</i>	<i>P. florida</i>	<i>P. sajor-caju</i>	<i>P. florida</i>	<i>P. sajor-caju</i>
1	386.4	312.4	4.7	2.2	15.4	12.5
2	170.9	181.1	2.5	1.9	6.8	7.3
3	171.4	72.8	5.3	1.4	6.9	2.9
4	121.1	110.6	3.8	1.1	4.8	4.4
5	21.4	28.3	1.8	1.0	0.9	1.1
6	44.5	—	2.4	—	1.8	—
7	11.4	—	1.5	—	0.5	—
8	5.7	—	1.1	—	0.2	—
Total	932.8	705.2			37.3	28.2

Table II. Performance of *Volvariella volvacea* on oil palm bunch refuse

Weeks after spawn run	Two layers MBW 38.25		Two layers MBW 83 Kg		Three layers MBW 112 Kg	
	BS (75 x 45 x 30 cm)		BS (150 x 45 x 30 cm)		BS (150 x 45 x 45 cm)	
	Mean yield (g)	Mean no. of mushrooms	Mean yield (g)	Mean no. of mushrooms	Mean yield (g)	Mean no. of mushrooms
1	1022.5	36.3	1610	77.0	2965	90
2	120.0	6.0	220	14.0	1285	57
3	224.8	10.8	380	17.0	585	29
4	37.5	2.0	240	19.0	310	18
5	32.0	3.0	15	1.0	423	30
Total	1436.8	58.1	2465	128.0	5568	224
MMW		24.7		19.25		24.85
CP		3.75		2.97		4.97

MMW — Mean Mushroom weight in gm.
CP — Conversion percentage.

MBW — Mean Bed weight in Kg.
BS — Bed size.

of production for 1 kg was worked out to be Rs. 15/- for *V. volvacea* and Rs. 17/- for *Pleurotus* spp. It may be pointed out that the cost can be reduced by increasing the efficiency of cultivation and improving conversion rate through further requirements in the experiments.

R.R. Nair, Scientist (S.G.), C.P.C.R.I., R.C., Palode for encouragement and to Shri V.K. Karthikeyan, Principal, Krishi Vigyan Kendra, Mitraniketan, Vellanad, Thiruvananthapuram for supply of a culture of *P. sajor-caju*. The supply of substrates by Oil Palm India Ltd., is gratefully acknowledged.

REFERENCES

- CHANG, S.T. and QUIMIO, T.H. 1982. *Tropical Mushrooms: Biological nature and cultivation methods*. The Chinese Univ. Press, Hong Kong, 363p.
- MUTHURAJAH, R.N. 1983. Potential chemical and industrial uses of Oil Palm mill bulk waste. In *Proc. "National Workshop on Oil Palm Byproduct utilization"* 14-15 Dec. 1981, PORIM, Kuala Lumpur, Malaysia, pp. 140-147.
- NAIDU, N.R. 1971. Cultivation of paddy straw mushroom (*Volvariella volvacea*) using oil palm bunch waste as a medium. *Plantae*. **47** (542) : 190-193.
- SARKAR, B.B. and CHAKRAVORTHY, D.K. 1986. Improved cultivation technique for *Volvariella volvacea* (Bull. Ex. Fr.) Sing. *South Indian Horticulture*. **34** (1) : 35-39.
- YONG, T.A. 1986. Utilization of Oil Palm Pericarp Waste for the cultivation of Abalone mushroom (*Pleurotus cystidiosus*, Strain T.O.). *Singapore J. Primary Industries* **4** (1) : 27-35.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. M.K. Nair, Director, Central Plantation Crops Research Institute, Kasaragod for encouragement and facilities provided. The constant encouragement and guidance rendered by Dr. K.U.K. Nampoothiri, Scientist-in-charge, C.P.C.R.I., Research Centre, Palode and Dr. K.K.N. Nambiar, Head, Crop Protection, C.P.C.R.I., Kasaragod are thankfully acknowledged. The authors are also grateful to Dr.