National Symposium on Mushroom Cultivation 22-24 Jan 19
Trivandrum

Cultivation of oyster mushroom on rubber processing factory waste - A possible solid waste utilization method

JACOB MATHEW, R., KOTHANDARAMAN AND KOCHUTHRESIAMMA JOSEPH

Rubber Research Institute of India, Rubber Board P.O., Kottayam 686 009

A preliminary study was carried out to find out the feasibility of growing oyster mushroom (*Pleurotus florida*) on solid waste from crumb rubber processing factories and in combination with different levels of paddy straw. This waste was found to support the growth of mushroom. A better growth of mushroom was observed on mixing the solid waste with paddy straw. Considerable reduction in C:N ratio of the spent compost was recorded.

Intensive agriculture in the last two decades has no doubt increased food production but the disposal of the plant residue is posing problems. Rubber production and processing are not an exception in this regard. The centralised bulk processing of rubber into block form and crepe form generate enormous quantity of liquid and solid wastes. Although many treatment systems are available for liquid wastes (Ponniah, *et al.*, 1975) no satisfactory disposal system was deviced for solid wastes. Fermentation of solid waste using mushroom is reported to be much effective in reducing pollution due to lignocellulosic wastes from agro industries (Birch, *et al., 1976). A study was initiated to explore the possibility of culturing oyster mushroom, Pleurotus florida* on solid waste from crumb rubber processing factory and in combination with paddy straw in different proportions. Studies were also conducted to fix optimum levels of spawn and calcium carbonate.

MATERIALS AND METHODS

Solid waste from the rubber trap of the crumb rubber processing factory was collected, dried and strained to remove visible particles of rubber and sand. This solid waste was boiled in water for 30 mts., and used for mushroom cultivation.

Calcium carbonate was mixed with solid waste at 1,2,3,4 and 5 per cent level and cultivated mushroom with 4 per cent spawn. Yield from three crops were collected and recorded. Pre-treated solid waste was mixed with 2 per cent calcium carbonate and used for cultivating mushroom at 4 and 8 per cent levels of spawn. Mushroom was collected and the yield was recorded. Paddy straw was cut into pieces of 2.5 to 5.0 cm size soaked, in water for 12 hrs, boiled for 30 mts. and mixed with the solid waste. Paddy straw and solid waste were used as such and mixed at 50 and 75 per cent by weight.

Two kilograms of the substrates after adding 2 per cent calcium carbonate, except for 100 per cent paddy straw, was taken in plastic containers of 38 x 28 x 8 cm., size and spawned with 4 per cent grain spawn. The trays were covered with transparent polythene sheets of 80 - 100 gauge thick having two holes of 1 cm diameter. Spawn running at 24 $\pm$ 2°C and RH 80-85 in dark for 10 days, followed by three croppings were carried out. Total nitrogen and organic carbon in spawned surface as well as spent compost were estimated following standard methods.

RESULTS

Oyster mushroom (*P. florida*) grew well on solid wastes of rubber processing factory and primordia production was initiated in 10 days. The yield of mushroom on solid waste was 470 g/kg as against 560 g/kg of straw. Mixing both the substrates in equal proportion recorded the highest yield (Table 1). An yield increase of 32.3 per cent was noticed when both the substrates were used in equal quantity. The C:N ratio of solid waste and paddy straw were 30:1 and 60:1 respectively. The reduction in C:N ratio by mushroom cultivation ranges from 45 to 53 per cent (Fig.1). The mushroom yield increases with increase in C:N ratio of the substrate upto 46:1 per cent and further increase has negative effect. (Fig 2).

The difference in yield between 4 per cent and 8 per cent levels of spawning was negligible, ie, 455 g. and 460 g. respectively. Incorporation of calcium carbonate upto 2 per cent augmented mushroom yield on solid waste. However, further increase of this

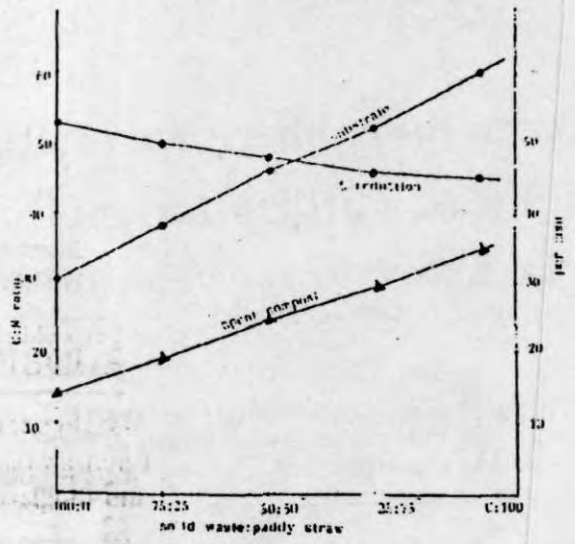

Fig 1 C.N. Ratio at different combinations and percentage reduction

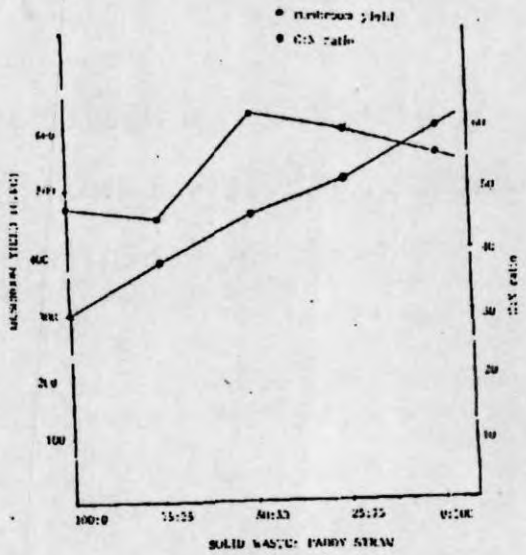

Fig 2. Relationship between yield and C.N. Ratio

chemical has little influence on yield of mushroom (Table 2).

Table - 1: Mushroom yield at different combinations of solid wastes and paddy straw.

Treatments		Weight of mushroom g/kg of substrate	Bio-efficiency
Solid waste (%)	Paddy straw (%)		(%)
100	-	470	47
75	25	465	47
50	50	623	62
25	75	595	60
--	100	560	56

Table - 2: Influence of levels of calcium carbonate on yield of Mushroom (g/kg of substrate)

Levels of calcium carbonate (%)	Yield
0	403
1	460
2	468
3	465
4	465
5	460

DISCUSSION

In the present study, though the yield of *P.florida* in solid waste is less when compared to paddy straw, it has significant effect in narrowing down the C:N ratio in spent compost. Enhanced yield of mushroom in the 50 : 50 mixture of solid waste and paddy straw indicates the possibility of commercial cultivation using waste from crumb rubber factories. Alexander (1961) reported that fungi in general require wider C:N ratio, which is specific for each fungus. Mushroom growth removes 50 per cent of carbon in the form of carbon dioxide and 10 per cent as fruit bodies (Zadrazil, 1978) and reduce the carbon level. Another means of reducing C:N ratio is the increase of nitrogen in the substrate fixed by mushroom fungi (Cowling & Merrill, 1966; Rangswami *et al.*, 1975). The spent compost of mushroom culture with narrow C:N ratio is free from pollution and ideal to use as organic manure (Chang & Li, 1982).

Mushroom fungi, in general produce organic acids and reduce the pH of the substrate (Zadrazil & Schneideriet, 1972) which favour the spread of mycelia only. The pH optimum for primordia formation in oyster mushroom is around 6.5 (Eger, 1978). The addition of calcium carbonate at 2 per cent level might be sufficient to retain the optimum pH for primordia development.

The present study clearly indicate the possibility of carrying out fermentation of solid wastes from rubber processing factories with and without the incorporation of paddy straw. However, it warrants detailed investigations on the presence of any toxic chemicals in the sporocarps absorbed from the wastes before recommendation.

The authors are thankful to Dr.K. Jayarathnam, Dy. Director, Plant Pathology for his valuable guidance and to Dr.M.R. Sethuraj, Director of Research for the facilities provided.

REFERENCES

Alexander, M (1961). *Introduction to Soil Microbiology*, John Wiley & Sons Inc. U.S.A.

Birch, G.G., Parker, K.J. & Worgan G.T. (1976). *Food from wastes*. Applied science publishers, London.

Chang, S.T. & Li, S.F. (1982) Mushroom Culture. *In Advances in Agricultural Microbiology* (ed. Subba Rao N.S.) Oxford and IBH Publishing Company, New Delhi.

Cowling, E.B. & Merrill, W. (1966). Distribution and reuse of nitrogen in wood destroying fungi. *Holz V. Organism, Beiheft* 1, 269-274.

Eger C. (1978) Biology and breeding of *Pleurotus* In. *The Biology and cultivation of Edible Mushrooms* (ed. Chang S.T. & Hayes, W.A) pp. 407-419, Academic press Inc, New York.

Ponniah, C.D, Chick, W.H. & Scow, C.M. (1975). Treatments of effluents from rubber processing factories. In *Proceedings of the International Rubber Conference*, pp. 367-372, Kula Lumpur.

Rangaswami, G., Kandasamy T.K. & Ramaswamy, K. (1978). *Pleurotus sajor-caju* (Fr) Singer a protein rich nitrogen fixing mushroom fungus. *Current Science* 44, 403-404

Zadrazil, F. (1978). Cultivation of *Pleurotus* In *The Biology and Cultivation of Edible Mushrooms*. (ed Chang, S.,T & Hayes, W.A) Academic press Inc, New York

Zadrazil, F. & Schneidereit, M. (1972). *Grundlagen fur die In Kulturnalime einer bisher nicht Kulfivierten Pleurotus. Art. Champighen*, 12, 25-53.

□