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# Evaluation of Waterhyacinth and Paddy Straw Waste for Culture of Oyster Mushrooms

M. NAGESWARAN[1], A. GOPALAKRISHNAN[2], M. GANESAN[2], A. VEDHAMURTHY[2] AND E. SELVAGANAPATHY[3]


## ABSTRACT

Waterhyacinth (*Eichhornia crassipes* (Mart.) Solms.) was evaluated at ratios of 25, 50 and 75% with paddy straw (*Oryza sativa* L.) for oyster mushroom (*Pleurotus sajor-caju)* cultivation. There was an increase in yield with decreasing ratio waterhyacinth. Waterhyacinth is the only growth substrate resulted in very poor yield. However, there was an increase in yield of 276 g with an addition of 25% waterhyacinth with paddy straw compared to an increase of 231 g in pure paddy straw. An average size of 38 $cm^2$ and weight of 5.5 g for individual mushrooms were the highest with the addition of 50% waterhyacinth plants to paddy straw.


*Key words: Pleurotus sajor-caju*, utilization of aquatic weeds, oyster mushroom and mushroom biological efficiency, protein production, *Eichhornia crassipes, Oryza sativa.*

## INTRODUCTION

Cuddalore district in the Tamil Nadu state in India has an abundance of waterhyacinth. This weed adversely affects the human and animals, waterways, and agriculture by covering the ponds and lakes and lowering dissolved oxygen in the water bodies. In African countries, waterhyacinth is used as supplementary substrate for oyster mushroom production (Tagwira et al. 1998). They have reported an addition of 10% waterhyacinth supplement to a substration of sawdust and groundnut shells increased oyster mushroom production by 250% and 221%, respectively.

Paddy straw is available abundantly in Cuddalore region in Tamil Nadu in India. In this study, we used waterhyacinth as a supplement to paddy straw to evaluate this aquatic plant on the production of oyster mushroom.

## MATERIALS AND METHODS

Studies were conducted during January to March 2002 in the field office of M. S. Swaminathan Research Foundation located at Keelamanagudi village in Chidambaram taluk of Cuddalore district of Tamil Nadu in India. Paddy is the most important food crop of the world and grown in a wide range of environment. In paddy fields, rice is harvested with mechanical harvester and the panicle together with a portion of the stem is removed.

Paddy straw serves as a major source of cattle feed in south India and was used as substrate in combination with waterhyacinth for oyster mushroom culture. The study was complete randomized block design with four replications. Treatments consisted of waterhyacinth alone, paddy straw alone, 75% waterhyacinth plus 25% paddy straw, 50% waterhyacinth plus 50% paddy straw and 25% waterhyacinth plus 75% paddy straw. Oyster mushroom cultivation was conducted as suggested by Krishnamurthy et al. (2000). Both waterhyacinth and paddy straw were chopped into section 2 to 5 cm long, soaked overnight in clean, fresh water. After draining excess water, water hyacinth was mixed at 25, 50 and 75% levels with paddy straw as per the treatment and boiled for 2 hours, strained, cooled and dried for 24 hours under shade. The processed plant material was used as a substrate for the cultivation of oyster mushrooms. Beds were prepared in poly bags with dimensions of 60 cm by 30 cm. The open end of each bag was tied with a rubber band after adjusting the weight with substrate to 2 kg. Each bag was punctured with 25 holes. The bags were placed in a cropping room where the relative humidity was maintained above 80% and bags sprinkled with

[1]Corresponding Author, Scientist, JRD Tata Ecotechnology Centre, M. S. Swaminathan Research Foundation, 3rd Cross street, Taramani Institutional Area, Chennai-600 113, Tamil Nadu, India.

[2]Scientist, JRD Tata Ecotechnology Centre, M. S. Swaminathan Research Foundation, 3rd Cross street, Taramani Institutional Area, Chennai-600 113, Tamil Nadu, India.

[3]Technical Assistant, Field Office, M. S. Swaminathan Research Foundation, Keelamanagudi village, Chidambaram (Tk), Cuddalore (Dt.)-608 501 Tamil Nadu, India. Received for publication February 3, 2003 and in revised form June 4, 2003.

TABLE 1. GROWTH, YIELD OF OYSTER MUSHROOMS WITH DIFFERENT RATIOS OF WATERHYACINTH AND PADDY STRAW.

| Substrate (%) | | Days until first harvest | Number of times harvested | Yield/kg substrate (g) | Size of individual mushroom ($cm^2$) | Individual mushroom weight (g) | Biological efficiency (%) |
|---|---|---|---|---|---|---|---|
| Waterhyacinth | Paddy straw | | | | | | |
| 100 | 0 | 13 | 8.0 | 182 | 28.3 | 4.6 | 65 |
| 0 | 100 | 17 | 6.5 | 231 | 33.1 | 3.7 | 69 |
| 75 | 25 | 16 | 6.0 | 154 | 32.4 | 4.8 | 52 |
| 50 | 50 | 14 | 7.5 | 225 | 37.6 | 5.5 | 73 |
| 25 | 75 | 16 | 6.5 | 276 | 36.9 | 5.0 | 85 |
| C.D. at 5% | | 0.99 | NS | 74 | NS | NS | NS |

C.D. = Critical Difference.

water twice a day. Mature fruiting bodies were removed from the bags and weighed when they grew to a harvestable size. Yield was calculated as fresh weight of mushrooms fruiting bodies produced per kg dry substrate. Biological efficiency was determined by the ratio of fresh mushrooms harvested to the substrate dry weight used in the study.

Total carbon and nitrogen were estimated as suggested by Tandon (1993) in the substrates before and after harvest. The collected data were subjected to statistically analysis as per the methods suggested by Gomez and Gomez (1996).

## RESULTS AND DISCUSSION

Harvesting of oyster mushrooms began within 13 days in the waterhyacinth alone substrate treatment (Table 1). For the paddy straw alone, oyster mushrooms were harvested after 17 days. The combination of waterhyacinth plus paddy straw resulted in harvests times between the 13 and 17 days times. The substrate of waterhyacinth and 50% waterhyacinth plus 50% paddy straw were suitable substrates for early harvests compared to other substrates tested. Oyster mushrooms were harvested eight times from waterhyacinth alone substrate whereas only six to seven harvests were made in the remaining substrates, but no statistical differences were calculated for the treatments. The yield data showed that the substrate of 25% waterhyacinth in combination with 75% paddy straw gave a significantly higher oyster mushroom production of 276 g followed by paddy straw alone as compared to the other treatments. The lowest yield was obtained in 75% waterhyacinth in combination with 25% paddy straw substrate. The size and weight of individual oyster mushrooms were not different for the various substrates. Biological efficiency was determined as the percentage conversion of dry substrate to oyster mushroom fresh weight, but there were no differences among the treatments.

Biochemical analysis of the substrates used for the culture of oyster mushroom revealed that the highest carbon and nitrogen content were recorded in paddy straw as compared to the other substrates (Table 2). Carbon and nitrogen content of the paddy straw decreased after harvest compared to pre-harvest sample. In the case of waterhyacinth the levels of carbon and nitrogen were essentially the same after harvest as before.

This study shows that waterhyacinth can be mixed with paddy straw at the ratio of 25:75 for production of oyster mushrooms. By using waterhyacinth plants to produce oyster mushrooms aquatic weed problems could be reduced to some extent. Local villagers need to be motivated to make use of waterhyacinth plants as a substrate in combination with paddy straw for cultivation of oyster mushrooms as the oyster mushrooms provide an inexpensive source of protein for human consumption.

TABLE 2. ANALYSIS OF SUBSTRATE FOR CARBON AND NITROGEN.

| Substrate (%) | | Before harvest | | After harvest | |
|---|---|---|---|---|---|
| Waterhyacinth | Paddy straw | C (%) | N (%) | C (%) | N (%) |
| 100 | 0 | 29 | 2.5 | 30 | 2.6 |
| 0 | 100 | 48 | 4.2 | 29 | 2.5 |
| 75 | 25 | 32 | 2.7 | 29 | 2.5 |
| 50 | 50 | 36 | 3.1 | 24 | 2.0 |
| 25 | 75 | 43 | 3.6 | 26 | 2.2 |
| C.D. at 5% | | 1 | 0.2 | NS | NS |

C.D. = Critical Difference.

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