The Journal of Food Technology in Africa, ISSN: 1028-6098
Innovative Institutional Communications

The Journal of Food Technology in Africa Vol. 7 No. 3, 2002, pp. 98-100

Performance of different strains of *Pleurotus* species under Ghanaian conditions

M. Obodai[1] and K.A. Vowotor[1]

[1]Food Research Institute (CSIR), Box M20, Accra, Ghana.

Code Number: ft02023

ABSTRACT

The spawn run period, time for first appearance of mushrooms, number of flushes and biological efficiency (yield) of eight different strains of oyster mushrooms grown on composted sawdust of *Triplochiton scleroxylon* K (Schum) were studied. The spawn run period on the compost bags for the strains ranged from 40-48 days. *Plewotus citrinopileatus* strain PCB showed very poor and patchy growth and the mycelium never fully colonised the substrate. This indicates that the different strains of the mushrooms utilize the given substrate at different rates. The time for first appearance of mushrooms ranged from 4 to 35 days. With the exception of *P. burundii* strain HK-51, which produced only one flush, all strains produced at least three flushes. *Pleurotus eous* strain Kapak, the highest yielding strain produced six flushes. With all the strains flush 1 gave the highest yield of 63.9g, and flush 6 the lowest yield of 0.9g. *Pleurotus eous* strain Kapak gave the best yield and biological efficiency whilst *P. burundii* strain HK-51 produced the least yield. *P. citrinopileatus* strain PCB did not produce any fruiting bodies during the period of study. Significant differences ($P<0.05$) in yield of the different species of mushrooms were recorded.

Key words: Mushrooms, flushes, biological efficiency

INTRODUCTION

Mushrooms, a highly priced delicacy for more than two thousand years, are now consumed by many people in Ghana. It has high nutritive and medicinal value, and contributes to a healthy diet because of its rich source of vitamins, minerals and proteins (Garcha *et al.*, 1993). In Ghana, mushrooms are traditionally collected from the wild in forest regions during the wet season *from* March to September. With the introduction of the plastic bag method in 1990, edible and medicinal mushrooms can be produced all year round on composted sawdust of *Triplochiton scleroxylon* popularly known in Ghana as ëwawaí, a relatively abundant timber species whose sawdust has a short composting period.

Since 1990, 11 different species of mushrooms have been received from all over the world, including countries such as Belgium, Cameroon, Malaysia, Mauritius, South Africa, Sri-Lanka, Switzerland, Thailand and the United States of America. Among the mushrooms received are the oyster mushrooms (*Pleurotus* spp.), woodear mushrooms (*Auricularia* spp.), monkey head mushrooms (*Hericium* spp.), monkey seat mushrooms (*Ganoderma* spp.) and the giant stropharia (*Stropharia rugoso-annulata*).

Oyster mushrooms which have a wide range of temperature adaptability (Bano & Rajarathnam, 1982), and substrate utilization (Poppe, 2000) have been accepted by the Ghanaian populace for their taste, nutritional and medicinal properties (Garcha *et al.*, 1993).

Although various workers have studied the growth conditions and substrate utilization of various mushrooms in many countries, there has not been any attempt to study the spawn run period, time of first appearance, number of flushes as well as biological efficiency of these strains of Pleurotus species under Ghanaian environmental conditions. This paper, therefore reports on the performance of eight different strains of Pleurotus species grown on composted sawdust of *Triplochiton scleroxylon*.

MATERIALS AND METHODS

The experiment was conducted between January and March 1997. The mushroom species and strain used for the study and their countries of origin used are listed in **Table 1**.

All strains were maintained on potato dextrose bean extract agar slants and used for the preparation of sorghum spawn as described by Zadrazil (1978). Both cultures and spawn were incubated at 26-28°C. Eighty-eight parts of freshly milled T. scleroxylon sawdust (moisture content 30 ±2% wet basis), was thoroughly mixed with 10 parts of rice bran and 1 part each of calcium oxide and NPK fertilizer (23:15:5). Water was sprinkled on the mixture until moisture content was about 70 ± 2% wet basis. The mixture was piled up into a pyramidal heap and allowed to ferment, for 21-28 days. It was turned every fourth day to ensure uniform composting. One kg quantities of the composted sawdust were put into forty 33 x 18 cm heat-resistant, 0.1µm polypropylene bags (Auetrugal, 1984). Each bag was closed with a plastic neck, steam-sterilised for 2.5 h, inoculated with 5g sorghum spawn and incubated at 30 ± 3°C and 65 ± 5% RH for 41 to 48 days in a well ventilated, semi-dark room.

The spawn run period is calculated as the number of days from inoculation to complete colonisation of the compost bag by the mycelium. After completion of the spawn run, the bags were transferred to a cropping house, at 28 ± 3°C and 90 ± 5% RH, and opened to induce fruit-body formation. The number of days from the opening of the bags until the first appearance of the mushroom was recorded. The biological efficiency, (BE) or the percentage of the fresh weight of mushrooms to the dry weight of the compost at spawning was also calculated. Each mushroom strain was replicated five times. The control culture was *P. ostreatus* strain EM-1, which is currently being distributed to commercial farmers in the country. The mean yield of the different strains was subjected to a oneway analysis of variance and the differences between mean yield were tested using the Scheffe test at a = 0.05. All statistical analyses were done using SPSS 10 for Windows (1999).

RESULTS

P. ostreatus strain EM-1, *P .eous* strain Kapak and *P. eous* strain OS-1 showed good dense mycelium growth on the substrate. The spawn run period was between 40 and 41 days (**Table 2**). Complete mycelium growth for *P. sajorcaju* strain PSB, *P. quebeca* strain PQB, *P .burundii* strain HK-51 and *P. eous* strain PD-4 was between 46 and 48 days. *P. citrinopileatus* strain PCB produced very poor and patchy growth and the mycelium did not fully colonise the substrate during the period of study. The fruiting bodies of *P. eous* strain Kapak became apparent only 4 days after opening the bags in the cropping house, as compared to *P. quebeca* strain PQB, which took the longest period of 35 days. With the exception of *P. burundii* strain HK-51, which produced only one flush, all strains produced at least three flushes within the study period. *P. eous* strain Kapak, the highest yielding strain produced six flushes (**Table 3**).

Across all strains, flush 1 gave the highest mean yield of 63.9g and flush 6 the lowest mean yield-oil 0.9g (**Fig.1**). Flush 2, produced the second highest mean yield of 25.8g. No significant differences (P>0.05) were found between flushes 3, 4 and 5, and between flushes 4,5 and 6, which were the two intermediate groups. Although by flush 2 more than 60% of the total yield of the fruit-body had been obtained, the proportional weight of mushrooms obtained per flush shows the importance of continuously harvesting till flush 6 (**Fig. 1**).

During the 8 weeks of cropping, *P. eous* strain Kapak gave the best mean yield of 28.9g and B.E of 57.74 % followed by *P. ostreatus* strain EM-1 with 25.5g and of 50.93%, respectively (Fig. 2). The lowest mean yield of 9.9g was produced by *P. burundii* strain HK-51. These eight strains gave BE values of 6.30% to 57.74% (**Table 3**)

DISCUSSION

The different mycelial density and growth rates exhibited by all the eight strains indicate that the different strains of the mushrooms utilize the given substrates at different rates. Thomas *et al.*,(l99S) reported that the yield of the mushroom is directly related to the spread of mycelium into the substrate. *P. eous* strain Kapak gave the best mean yield of 28.9g and B.E of 57.74 % followed by *P. ostreatus* strain EM-1 with 25.5g and of 50.93%, respectively (Fig. 2). The lowest mean yield of 9.9g was produced by *P. burundii* strain HK-51. These eight strains gave BE values of 6.30% to 57.74% (Table 3) Differences in BE may have affected the yield. The BE values, the yield of mushrooms in relation to the dry weight of substrate at spawning, indicate how different strains utilise the substrate (Mueller *et al.*, 1985).

According to Chang and Miles (1982), BE of P. sajor-caju can be increased to nearly 100% depending on the composition of the substrate. Martinez *et al.* (1984) also recorded a value of 132.0% for *P. ostreatus* grown on fermented coffee pulp. Ambient temperature changes may also account for the differences, since the fruiting of the mushrooms is temperature dependent, varying between 10 and 30°C (Oei, 1996). For example, *P. ostreatus* (Jacq. ex. Fr) Kummur fruits well at temperature ranges of 15.5 and l8°C (Stamets and Chilton, 1983), while P. sajor-caju produce fruiting bodies between 20 and 30°C (Jandaik and Kapoor, 1976).

P. eous strain Kapak, originally from South Africa, is the best variety to be cultivated during the period from January to March. On the basis of this experiment, commercial mushroom farmers in Ghana and other West African countries will have to be advised accordingly to take advantage of this strain for increased yields during this period of the year.

ACKNOWLEDGEMENT

We would like to acknowledge the technical support of R. Takli and G. Agbeley, Technician and Labourer, respectively, attached to the Food Research Institute Mycology Unit.

REFERENCES

- **Auetrugal, A 1984.** The highest aspect for cultivating oak mushroom (Lentinula edodes) in plastic bags, Mushroom Newletter for the Tropics 5: 11-15.
- **Bano, Z. and S. Rajarathnam. 1982.** Pleurotus Mushroom as a Nutritious Food. In S. T. Chang T. H. Quimio (eds). Tropical Mushrooms: Biological Nature and Cultivation methods. The Chinese University Press.
- **Chang S. T. and P. G. Miles 1982**. Introduction to Mushroom Science. In S. T. Chang T. H. Quimio (eds). Tropical Mushrooms: Biological Nature and Cultivation methods. The Chinese University Press. 3-10.
- **Garcha, H. S., P. K. Khann. and G. L. Soni 1993.** Nutritional Importance of Mushroom. In S. T. Chang J. A.Buswell S. Chiu (eds). Mushroom biology and Mushroom Products. The Chinese University Press .227-235
- **Jandaik, C. L and J. N. Kapoor 1976.** Studies on the cultivation of Pleurotus sajor-caju. Mushroom Science. 9: 667-672.
- **Martinez, D, G. Guzman and C. Sota 1984**. The effect of fermentation of coffee pulp in the cultivation of Pleurotus ostreatus in Mexico. Mushroom Newsletter for the Tropics. 6:21-27.
- **Mueller, J. C. Gawley, J. R. and W. A. Hayes 1985.** Cultivation of the shaggy mane mushroom (Coprinus comatus) on cellulosic residues from pulp mills. Mushroom Newsletter for the Tropics, 6: 15-20.
- **Oei, P. 1996.** Mushroom Cultivation-with special emphasis on appropriate techniques for developing countries. Tools Publications, The Netherlands.
- **Poppe, J. 2000.** Use of agricultural waste materials in the cultivation of mushrooms. Mushroom Science, 15: 3-23.
- **SPSS 10 for Windows (1999).** SPSS 10 for Windows.. Chicago. Illinois, USA
- **Stamets P. and J. S. Chilton 1983.** The Mushroom Cultivator. Agarikon press, Olympia, Washington.
- **Zadrazil F. 1978.** Cultivation of Pleurotus spp. In: Chang S. T. and W. A. Hayes (eds) The biology and cultivation of edible mushrooms Chinese University Press.

Contact: The Journal of Food Technology in Africa

The following images related to this document are available:

Photo images

[ft02023f1.jpg] [ft02023f2.jpg] [ft02023t1.jpg] [ft02023t2.jpg] [ft02023t3.jpg]

Fig. 1. Mean yield of seven *Pleurotus* species grown on composted sawdust

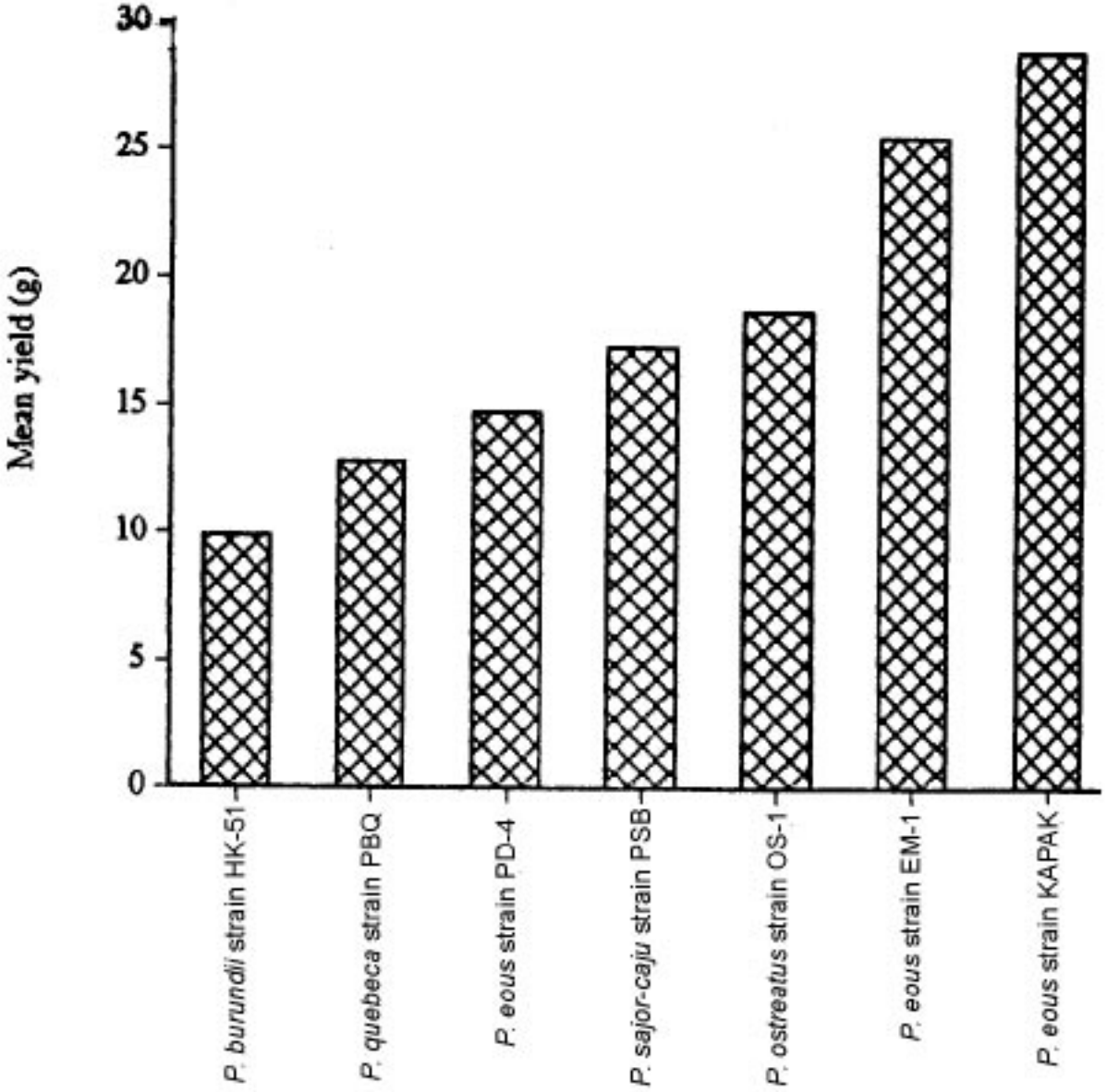

Fig. 2. Mean yield per flush of *Pleurotus* species grown on composted sawdust

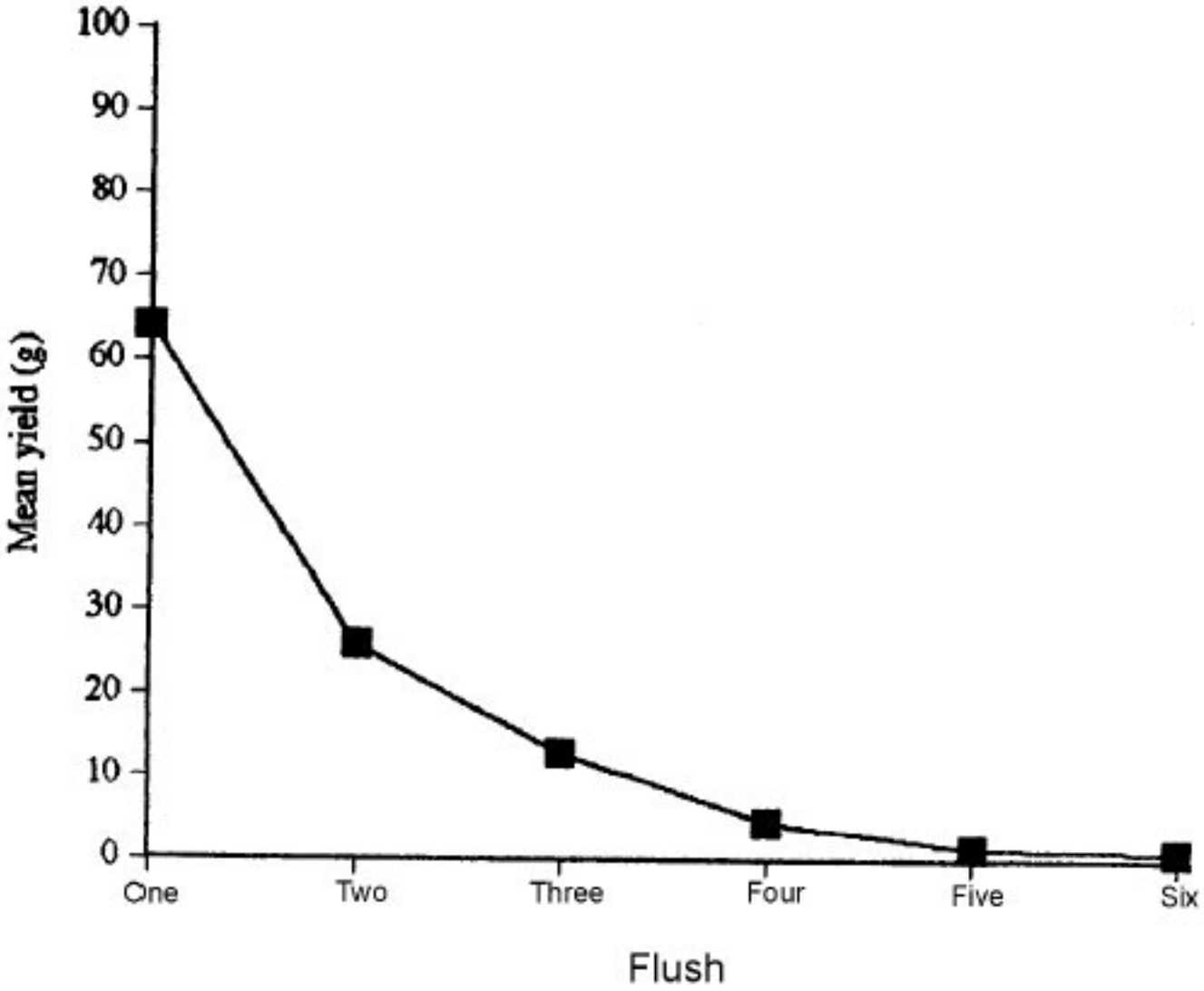

Table 1. Species and strains of oyster mushroom used for the study

***Pleurotus* species**	**Origin**	**Strain**
P. sajor-caju	Belgium	PSB
P. quebeca	Belgium	PQB
P. burundit	Belgium	HK-51
P. citrinopileatus	Belgium	PCB
P. ostreatus	Mauritius	EM-1
P. ostreatus	Switzerland	OS-1
P. eous	South Africa	Kapak
P. eous	Cameroon	PD-4

Table 2. Mycelium growth rate of eight strains of *Pleurotus* species grown on composted sawdust

***Pleurotus* species**	**[1]Surface mycelial density**	**Spawn run period (days)**
P. sajor-caju strain PSB	++	46
P. quebeca strain PQB	++	46
P. burundii strain HK-51	++	48
P. citrinopileatus strain PCB	+	ND
P.ostreatus strain EM-1	+++	41
P. ostreatus strain OS-1	+++	40
P. eous strain Kapak	+++	40
P. eous strain PD-4	++	46

[1]Degree of mycelia density when the mycelia fully colonises the substrate
+++ = when the mycelium totally runs through bag and uniformly white
++ = when mycelium totally runs through bag but not uniformly white
+ = Poor patchy growth
ND= No data available

Table 3. Yield performance of different strains of *Pleurotus* species grown on composted sawdust

Strains	Days from bag opening to first flush	Yield/Flushes (g)[1]						Total yield (g)	Biological efficiency (%)
		First	Second	Third	Fourth	Fifth	Sixth		
P. sajor-caju strain PSB	30	67.1 ± 0.5	30.1 ± 0.6	3.8 ± 0.7	2.4 ± 0.5	ND	ND	103.4	34.47
P. quebeca strain PQB	35	53.4 ± 0.4	24.0 ± 0.6	7.9 ± 1.4	ND	ND	ND	85.4	28.45
P. burundii strain HK-51	7	18.9 ± 0.2	ND	ND	ND	ND	ND	18.9	6.30
P. citrinopileatus strain PCB	ND	ND	ND	ND	ND	ND	ND	ND	ND
P. ostreatus strain EM-1	8	67.9 ± 0.7	36.5 ± 0.3	29.9 ± 0.5	19.3 ± 0.6	ND	ND	152.8	50.93
P. ostreatus strain OS-1	12	70.0 ± 0.6	29.3 ± 1.2	9.9 ± 0.1	1.7 ± 0.9	ND	ND	111.9	37.27
P. eous strain Kapak	4	72.2 ± 0.9	37.1 ± 0.4	40.0 ± 0.8	7.3 ± 1.2	10.1 ± 0.1	6.5 ± 0.8	173.2	57.74
P. eous strain PD-4	5	72.6 ± 0.8	48.3 ± 0.4	15.3 ± 0.2	1.4 ± 0.8	3.0 ± 0.2	ND	140.6	46.86

1 Mean of five replicates

ND= No data available