Cultivation Performance of *Pleurotus Pulmonarius* in Maiduguri, North Eastern Nigeria, Using Wood Chippings and Rice Straw Waste.

1Akinmusire, O.O, 1Omomowo, I.O., 2Oguntoye, S.I.K

Department of Microbiology, University of Maiduguri, Borno State, Nigeria.

Akinmusire, O.O, Omomowo, I.O., Oguntoye, S.I.K: Department of Microbiology, University of Maiduguri, Borno State, Nigeria.

ABSTRACT

An attempt was made to investigate the potential of growing *Pleurotus pulmonarius* in the hot climatic weather environment of Maiduguri, Nigeria by using cheap and easily available waste materials. The steps involved in the cultivation were composting the substrates, bagging the substrates, sterilizing the bagged compost, spawning, incubation and cropping. A completely randomized design was used with two treatments and five replications. An un-inoculated bag served as the control. On the average, spawn run duration, pinhead formation and fructification was faster for the rice straw substrate when compared to the sawdust substrate. It took an average of 22 days for the spawn run in rice straw substrate, compare to 35 days for the sawdust substrate. Also, pinhead formation was faster in rice straw substrate when compared with sawdust substrate. The result showed the potential of cheap and easily available substrate for oyster mushroom production.

Key words: Spawning, Fructification, Pin Head, Waste Materials.

Introduction

Mushroom is a macrofungus with a distinctive fruiting body, which can either be epigeous or hypogeous and large enough to be seen with naked eye and to be picked by hand [3]. Mushrooms are saprophytes and grow well on organic matter. They grow luxuriantly in most part of the world on different substrates under different climatic conditions; these include within the rootlets of certain trees (as mycorrhiza) and on termitaria [14][15]. Mushrooms are grouped into four based on their natural substrate; Lignocolus (wood-inhabiting), Humicolous (humus inhabiting), Coprophilus (dung inhabiting) and Fungicolous (Fungus inhabiting), [15].

In Nigeria, however, cultivation of mushroom as agro-industry is virtually not existent, many people usually collect and eat the wild types [6][9], which sometimes lead to some fatal ailments [11][14]. Oei, [14] reported that mushroom is a major source of foreign exchange in China and the country is a major exporter of the product. Food materials needed for growth by man include food rich in animal protein like meat, milk and egg. In Nigeria, the diet of average Nigerian is majorly cereal and carbohydrate based due to poverty.

*Pleurotus* spp are edible mushrooms and are cultivated commercially in Europe, America and many Asian countries as well as in Australia [12][4]. *Pleurotus* are primary agent of decomposition of materials without chemical or fermentative action [5].

They can thus provide a profitable way of disposing off our organic waste, especially agricultural waste. This will go along way in checking pollution of the environment that results from dumping of agricultural waste. Mushrooms have been found to contain sugar, protein, fats and many minerals such as potassium, phosphorus, calcium, sodium and trace elements as well as vitamins A, B, B1, B2, B5, B6, B12, C and D[13][2]. Mushroom protein have been valued to be of better quality than those of legumes, meat, milk and eggs [6]. Mushrooms are also regarded as natural medicine because the polysaccharides of their cell wall stimulate the formation of antibodies in human bodies [18]. They also contain cholesterol - reducing substances and low carbohydrate content, which
makes them suitable as diet for high blood pressure, heart disease and diabetic patients respectively [17]. They can also serve as a good source of income to individuals and countries that cultivate them for commercial purpose.

In view of the importance of mushroom to man, his animals and the environment, it is good for each family to cultivate mushroom if only for their consumption. This study was designed to show the potential of cheap and easily available substrate for oyster mushroom production in Maiduguri.

Materials and methods

Materials:

- Sawdust, rice bran
- Rice straw
- CaCO₃
- Oil drum
- Plastic bags
- Substrate mixer
- Source of heat; fire wood
- Weighing scale
- Water

Collection of materials:

The spawn used in this study was obtained from LTC mushroom farm, Karsana farm village, opposite Dutse junction, off Kubwa express way, Abuja. It was made using cotton waste. The rice straw used was obtained from a rice plantation close to Mona Park Maiduguri. The sawdust was obtained from a saw-mill at Bama road, Maiduguri.

Preparation of Materials:

Preparation of Rice Straw:

The rice straw was soaked in water for a day. Then it was removed, drained, and cooled. Then it was packaged into five polythene bag and label bag 1-5, pasteurized by heating in a steel drum for eight hours and left to cool. Then the substrates were inoculated with spawn of *Pleurotus pulmonarius* and incubated at a temperature of 20-25°C in darkness by covering with a black polythene bag.

Preparation of sawdust:

using the weighing scale the materials were weighed using the following formula:

- Sawdust: 94kg
- Rice bran: 4kg
- CaCO₃: 1kg

The materials were mixed together with water as even as possible. Then packaged in five polythene bags and pasteurized by heating in a steel drum for eight hours, then inoculated with the spawn of *P. pulmonarius* and incubated at a temperature of 20-25°C in darkness by covering with a black polythene bag. Data were taken after several weeks showing the spawn run, primordial formation, and fruit body development.

Results and discussion

The results obtained from this study shows that *Pleurotus pulmonarius* can be cultivated in Maiduguri under favourable environmental conditions.

The result also shows a higher yield of *P. pulmonarius* on rice straw substrate than sawdust substrate as shown in the tables (1 and 2).

The result of this study shows that *Pleurotus pulmonarius* can be successfully cultivated on waste materials. This indicates that these wastes contain nutrients that support the growth of this mushroom. Okhuoya and Okogbo[10] attributed ability of mushroom substrates to support the growth of mushrooms to the presence of lignin, cellulose and mineral elements as well as its residual oil. The days taken for the completion of spawn run in rice straw was faster than that observed in sawdust, an average of 28 days for spawn run in rice straw was observed in all five bags although fruiting was only seen in bag 2 and bag 5 as shown in table 1. Obodai et al.,[8] reported that a mixture of lignocelluloses basis such as saw dust, rice bran, corn bran, banana leaves, field corn, grass and rice straw substrate positively affected the yield, mycelium run and the growth period of fruiting body of oyster mushrooms.

The spawn run in bag 2 and bag 5 that got to the fruiting level was in agreement with the findings reported by [16], where spawn run and fructification for *P. pulmonarius* grown in ligninocellulose waste took about 8-14 days. Although the primordial formation and fruit body development observed under this study took longer period.

The yield obtained from the sawdust substrate was quite low compared to that of rice straw and this substrate took a much longer period for spawn run, primordial formation and fruit body development. Only bag 2 and 4 got to the fructifying stage and only bag 4 fruited, while bag 2 has pin head formation which later dried up after few days. Our result was in accordance with other reports[7] which indicated that wood chips led to the longest growth period.

Nutritional and environmental factors have been indicted as limiting the growth of mushrooms.

The variation observed during this study between rice straw substrate and sawdust could be attributed to temperature and humidity in the growing zone. As a result of the high temperature, which was later reduced by constant watering, the yield was not large enough. A second flush was made possible from bag 5 of rice straw after the watering was adjusted.
Overall, rice straw proved better suitable in this part of the country since the yield was better. Most of the mushroom species possess the ability to degrade lignin, cellulose and hemicelluloses and to produce fruiting bodies containing most of the essential amino acids, valuable vitamins, minerals and low energy carbohydrates. *Pleurotus* species has the potential to convert cheap celluloses into valuable protein at a low cost.

*Pleurotus pulmonarius* which is broadly adaptive produces mushroom on a great array of organics debris. The observation that mushroom grows successfully on different substrates shows their potential for bioconversion of these substrates [1]. Because of *Pleurotus pulmonarius* tolerance to high temperature, its speedy fruiting and yield efficiencies, many cultivators are initially attracted to this mushroom.

As can be deduced from this study, *P. pulmonarius* actually fruited in Maiduguri, Borno state capital.

According to [16], the temperature requirements for *P. pulmonarius* range between 18°C - 29°C and relative humidity of 85-100%. This became a challenge which was encountered during the course of the study due to the fact that the average temperature of Maiduguri during the dry season is 40°C and that Maiduguri is characterized with a low relative humidity, the growth rate was slow as shown in tables 1 and 2. The temperature and humidity difference can be attributed to the cause of the long period experienced during the study.

**Conclusion:**

It can be concluded from this study that Maiduguri the capital of Borno state can adequately support the growth of mushrooms especially *Pleurotus pulmonarius* if optimized nutritional and environmental conditions are put in place. Rice straw proved better as compared with the yield from the sawdust substrate. Tapping into the benefits of commercial mushroom production in Nigeria will reduce the country’s unemployment rate, increase her food security and revenue base while bridging her rural-urban mycophagy gap. This study did not only show additional source of food and income, but also a means of checking environmental pollution through waste reuse.

In cultivating this mushroom, adequate favourable environmental conditions are necessary for a good yield. A mud house could be of great importance since it could help control the temperature and humidity. Since a moist environment is required, adequate watering is necessary even when using mud house.

Further research on suitable and inexpensive method of cultivating this specie and other species of mushroom is also recommended. Also studies on combination effects of substrates and cheap supplements should be carried out in-order to know the must efficient and cost-effective combination. The provision of safe sustainable access to edible and medicinal mushrooms in Nigeria can be achieved in a number of ways which may include; by promoting opportunities for co-operation between all stakeholders such as the mushroom farmers, researchers/mycologists, politicians and other mushroom prospectors (marketer, NGOs and government agencies on agriculture, youths and women etc.) in the country. Also through the creation of public enlightenment initiatives via talk shows on the positive potentials of mushrooms and mushroom products in radio and television programs, monthly newsletter, seminars and workshops. This will remove the negative publicity associated with mushrooms, increase market sources of edible mushrooms, limit the dangers associated with mushroom hunting from the wild and improve awareness on both the nutrient quality and benefits of mushroom consumption.

**References**


