# Growth and yield of Lentinus squarrosulus (M.) Singer a Nigerian edible mushroom as affected by supplements

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**Citation**

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**Abstract**

The effect of supplements on the growth of Lentinus squarrosulus (M.) Singer, a Nigerian edible mushroom was investigated. L. squarrosulus was cultivated on two different cellulosic waste supplemented with banana peel and poultry manure for four weeks vegetative growth and proximate composition of the sclerotia were monitored as an index of growth. The result showed that L. squarrosulus was able to utilize the supplemented agricultural waste for vegetative growth. Substrate supplemented with 5g and 10g poultry manure and banana peel improved mycelia extension. Wood waste of Cordia milleni supplemented with poultry manure induced the widest mycelia extension. The nutritional analysis of L. squarrosulus showed that carbohydrate was the most abundant nutrient (52.92%) and chloride was the most abundant element (0.59%).

## INTRODUCTION

Lentinus squarrosulus (M.) Singer is a highly priced edible mushroom of the Polyporaceae (Fasidi and Kadiri, 1995). It is common in the Nigeria territory and it is found on dead wood and grasses. Mushroom are of immense economic importance to man. In recent time, more and more emphasize have been laid on this aspect and many analysis and studies have been carried out in order to determine some way which it could be useful to life situation. Wood waste and agricultural waste are important input in the production of mushrooms especially the edible mushroom (Marcelo, 2001). Such wastes include straw, corncobs, sawdust, wood pulp, cotton waste, poultry waste are sufficient for cultivation (Tautorus, 1985). Several authors have reported on adequate production yield with the addition of supplements on principal substrate (Chang et al., 1981; Zadrazil and Grabbe, 1983; and Laborde et al., 1985).

These wastes can be put into some use in order to reduce their environmental hazards. This will fit into the current global attention which is aimed at sanitizing the environment. In view of this, this present study was undertaken to evaluate the effect of two different additives on the nutritional content of Lentinus squarrosulus Mont grown on wood waste of Cordia milleni and maize cob.

## MATERIALS AND METHODS

The sporophore of Lentinus squarrosulus was collected from the decaying wood of Mangifera indica at the Tai Solarin University of Education, Ijebu – Ode, Ogun State, Nigeria. The fruitbody of this mushroom was tissue cultured to obtained pure mycelia culture, which was maintained on the yeast extract enriched (0.5%) potato dextrose agar (Jonathan and Fasidi, 2003).

Substrates used for this study are wood waste of Cordia milleni and maize cob, The sawdust was obtained at a sawmill at Ijebu – Ode and the maize cob was obtained at the local market in Ijebu-Ode. The sawdust and maize cob were sun dried for a period of five days. Supplements used for this experiment were Poultry manure and Banana peel. The Poultry manure was collected from a local poultry in Ijebu-Ode and oven-dried at 80±2C for 5 days for and grounded to fine particles. The banana peel was also obtained from new market at Ijebu - Ode. It was sun dried for three weeks and further oven-dried at 80±2C for 7days and pounded to fine particles.

## CULTURE CONDITIONS

40g of the dry unfermented substrate was weighed into each of the screw caped bottles which were uniform in size. 5g and 10g of the additives were weighed onto each of the labeled bottles containing the substrates. The moisture content of the unfermented substrates were adjusted to 75% with sterile distilled water. Three replicate bottles were prepared. They were then sterilization for 15minutes at 1210C and 151bs/pressure. The fresh weight of each bottle was recorded before inoculation. They were allowed to cool down to anbient temperature before they were inoculated with 2.0g of the pure culture of the mushroom lentinus squarrosulus by using a sterile inoculating spatula. They were then kept in a very clean dark room at 30±2C. Supplements were not added to the controls and were kept under the same condition as the treatments. After completion of colonization of the substrates, they were opened for fruiting.The growth rate of the mycelia on different substrates was observed and measured. The density of mycelium was also observed visually and compares was made among the different substrate used. The growth of the organism inside the bottles was also observed daily for sclerotium and fruitbody production. After four weeks of incubation, the experimental bottles were harvested dried at 80±2C for 48 hours and their proximate contents determined.

## CHEMICAL BIOMASS COMPOSITION

Proximate composition of fruit bodied was determined according the method of AOAC, (1984). The ash content was obtained in the muffle furnace after 3 hours at 550C. N total was determined by the Kjedahl method. The crude protein was obtained using the conversion factor (N x 6.25) and the Soxhlet device to extract the crude fat and carbohydrate determined by the phenol sulphuric acid method of Dubois et al., (1956).

Ca, Mg, Cu, Fe, Mg and Cl were determined by atomic absorption spectrophotometry, P by colometry, Na by flame photometry

## STATISTICAL ANALYSIS

Rating results in each treatment of triplicate experiments were subjected to analysis of variance (ANOVA) using general linear model option SAS. Test of significance were determined by Duncan's multiple range test at 0.5% level of probability.

## RESULT

The daily air relative humidity (%) and the local room temperatures (C) averages, where the bags with the composts remained after being opened were respectively, 65.8± 3.56 and 32.06± 1.86.

Lentinus squarrosulus showed white mycelium that ramified the entire compost after 7 days of incubation at 30±2. However it was observed that in the compost with maize cob supplemented with poultry manure ramification was faster with higher mycelia density than in the compost containing wood waste of Cordia milleni supplemented with banana peel (table 1). There was however, no significant difference in the values of the supplemented substrates when compared with the control. In compost with 5g of the supplements of banana peel and poultry manure the mycelia length for the mushroom was 5.8± 1.65 and 5.2± 0.02 for banana peel on wood waste of Cordia milleni and maize cob after incubation while it was 7.8± 0.73 and7.3±0.32 respectively. In addition when the supplement was increased to 10g there was no significant increase in the mycelia length was observed. The best mycelia length 7.8cm ±0.73was were obtained on maize cob supplemented with 5g poultry manure. While the least mycelia length (1.5± 0.23) was observed in on maize cob supplemented with 10g poultry manure. (Tables 1 and 2).

### Figure 1

TABLE 1: Mycelia growth of on supplemented Wood waste of

| Time of full mycelia colonization (Days) | Control | Wood waste of *Cordia milleni* Banana Peel (g) | | Poultry Manure (g) | |
|---|---|---|---|---|---|
| | | 5 | 10 | 5 | 10 |
| 2 | 1.7$^{c}$±0.13* | 4.3$^{a}$±0.09 | 5.4$^{a}$±0.04 | 2.7$^{b}$±0.03 | 1.5$^{b}$±0.23 |
| 4 | 4.5$^{b}$±2.01 | 5.3$^{a}$±1.03 | 6.9$^{a}$±0.02 | 2.7$^{b}$±0.03 | 1.6$^{b}$±0.24 |
| 6 | 6.0$^{a}$±0.01 | 5.7$^{a}$±1.79 | 6.9$^{a}$±0.20 | 6.4$^{a}$±1.90 | 3.8$^{a}$±1.19 |
| 7 | 6.1$^{a}$±0.03 | 5.8$^{a}$±1.65 | 6.9$^{a}$±0.02 | 7.8$^{a}$±0.73 | 4.2$^{a}$±1.62 |

*=Mean of three replicate± standard error

Mean values on the same column followed by the same letters are not significantly different at $p<0.05$ according to Duncan's multiple range test.

### Figure 2

TABLE 2: Mycelia growth of on supplemented Maize cob

| Time of full mycelia colonization (Days) | Control | Maize cob Banana Peel (g) | | Poultry Manure (g) | |
|---|---|---|---|---|---|
| | | 5 | 10 | 5 | 10 |
| 2 | 3.9$^{b}$±0.02* | 4.2$^{a}$±0.07 | 5.5$^{a}$±0.03 | 2.5$^{b}$±0.04 | 2.6$^{b}$±0.13 |
| 4 | 6.5$^{a}$±0.20 | 4.7$^{a}$±0.20 | 7.4$^{a}$±0.40 | 6.1$^{a}$±0.35 | 6.5$^{a}$±0.01 |
| 6 | 7.0$^{a}$±0.01 | 5.1$^{a}$±0.04 | 7.4$^{a}$±0.16 | 7.3$^{a}$±0.14 | 6.9$^{a}$±0.08 |
| 7 | 7.3$^{a}$±0.19 | 5.2$^{a}$±0.02 | 7.6$^{a}$±0.12 | 7.3$^{a}$±0.32 | 7.1$^{a}$±0.07 |

*=Mean of three replicate± standard error

Mean values on the same column followed by the same letters are not significantly different at $p<0.05$ according to Duncan's multiple range test.

Table 3 shows the average of two analyses of some Lentinus squarrosulus biomass constituents, obtained in the composts with wood waste of Cordia milleni and maize cob. The values obtained were not significantly different from each other, however, higher values obtained in the mushroom biomass cultivated on wood waste of Cordia milleni with poultry manure as additives. (Table 3). Protein was the most abundant nutrient in the cultivated sclerotia and its value range from 23.55%±0.1 (on wood waste of Cordia milleni supplemented with banana peel) to 25.57%±0.01 (on maize cob supplemented with poultry manure) (Table 3). The percentage crude fiber contents of the cultivated sclerotia were generally low. (Table 3). With regard to protein, crude fat carbohydrate and ash, the sclerotia produced on maize cob supplemented with poultry manure were the richest.

Chloride was the most abundant mineral element in the cultivated sclerotia (Table 3). With regard to calcium, sodium and phosphorus contents, the sclerotia produced on poultry manure were the richer, whereas sclerotia produced on banana peel was the richer in chloride. (Table 3).

### Figure 3

Table 3: Proximate composition of in supplemented substrates

| Chemical Analysis | Biomass in wood waste of *Cordia millon* | | Biomass in maize cob | |
|---|---|---|---|---|
| | Banana peel | Poultry manure | Banana peel | Poultry manure |
| % Crude Protein | $23.55^{a}\pm0.1^{*}$ | $24.45^{a}\pm2.86$ | $23.89^{a}\pm0.07$ | $25.57^{a}\pm0.01$ |
| % Crude Fat | $1.89^{a}\pm0.009$ | $1.98^{a}\pm0.007$ | $1.78^{a}\pm0.001$ | $2.30^{a}\pm0.004$ |
| % Carbohydrate | $50.32^{a}\pm1.85$ | $50.12^{a}\pm0.12$ | $51.20^{a}\pm2.12$ | $52.19^{a}\pm0.14$ |
| % Ash | $11.86^{a}\pm0.01$ | $12.52^{a}\pm0.001$ | $12.42^{a}\pm0.42$ | $12.89^{a}\pm0.18$ |
| % Calcium | $0.17^{a}\pm0.0003$ | $0.21^{a}\pm0.0004$ | $0.18^{a}\pm0.001$ | $0.20^{a}\pm0.001$ |
| % Sodium | $0.31^{a}\pm0.01$ | $0.30^{a}\pm0.0004$ | $0.24^{b}\pm0.0001$ | $0.31^{a}\pm0.0004$ |
| % Chloride | $0.59^{a}\pm0.02$ | $0.54^{b}\pm0.0004$ | $0.48^{bc}\pm0.003$ | $0.39^{c}\pm0.0003$ |
| % Phosphorous. | $0.16^{b}\pm0.0001$ | $0.24^{a}\pm0.0001$ | $0.14^{b}\pm0.0001$ | $0.25^{a}\pm0.0001$ |
| % Magnesium | $0.13^{b}\pm0.0001$ | $0.17^{a}\pm0.0001$ | $0.17^{a}\pm0.0003$ | $0.17^{a}\pm0.0001$ |
| Significance ($p=0.05$) | NS | NS | NS | NS |

*=Mean of three replicate± standard error

Mean values on the same column followed by the same letters are not significantly different at $p<0.05$ according to Duncan's multiple range test.

## DISCUSSION

In this study, the substrates used supported the growth of L. squarrosulus. Addition of supplements enhanced mycelia growth but not significantly compared to the control. This result is in agreement with the findings of Fasidi and Kadiri 1990 and Ergun et al., 2003 that. L. squarrosukus. and other mushrooms such as Volvariella and Pleurotus are able to utilize various cellulose wastes and addition of supplements significantly increased spawn running, pin head formation, fruit body formation and mushroom yield. Poultry manure has been known to be a good nutrient supplement to sawdust for mycelia growth of L. squarrosulus. (Quimio et al.,1990). The growth of L. squarrosulus on different supplemented substrates may be due to the ability to secrete hydrolyzing and oxidizing enzymes, which could aid the decomposition of recalcitrant compounds in the wastes into utilizable compounds (Jonathan et al., 2008).The implication of this finding is that sawdust, maize cob, banana peel and poultry manure which are nuisance in our environment can be used successfully as substrates for the cultivation of L. squarrosulus. Composting of sawdust and maize cob for the growth of this fungus is therefore not necessary but growth accelerators such as poultry manure, cassava peels, banana peels, bone meal, maize meal, malt extract, can also be added.

The nutritional analysis of L. squarrosulus showed that carbohydrate was the most abundant nutrients (52.92%) while fat was the least abundant nutrients (2.30%). This result agrees with the finding of Kadiri and Fasidi (1993). They reported that mature Lentinus squarrosulus fruit bodies are rich in phosphorus, calcium, protein, fat and carbohydrates. In this case, the low percentage of fat suggest that they are very ideal for patients with cardiac diseases since fat deposition in the heart is the main cause of cardiac diseases (Fasidi and Ekuere, 1993). The high percentage of carbohydrate value indicates that they can be used as a source of energy, followed in order by protein content (25.57%) and it showed that protein content in mushroom when examined, its quality seems to be better than that of other vegetables and other legumes (Manning, 1985). The mineral elements content showed that chloride was the most abundant elements (0.59%). The high percentage of chloride enhanced the mycelia growth of the mushroom and it makes the mushroom to be healthy (Banjo, 2003). Followed in order was sodium (0.33%) which is good for the maintenance of tissue fluids.

L. squarrosulus (M.) Singer an edible Nigerian mushroom can be cultivated on local cellulosic wastes and logs with the addition of local supplements and can act as a rich source of various nutrients. They are therefore, very valuable.

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