# CULTIVATION OF *PLEUROTUS OSTERATUS VAR FLORIDA* ON CORN HUSK USING DIFFERENT CONCENTRATIONS OF POULTRY WASTE AS SUPPLEMENT.

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**ABSTRACT**

The possibility of cultivating *Pleurotus osteratus var florida* on corn husk using different concentrations of poultry waste as supplement was investigated. Two percent lime was applied to stabilize the pH of the substrate .Poultry wastes at 0, 1.5, 2.5, and 3.5 % on dry weight basis of the substrate was used to enrich the corn husk. The experiment was laid out in completely randomized design (CRD).Two mushroom flushes were obtained during the production cycle which provided the accumulated yield used in the production analysis. Effects of different concentrations of poultry waste on the growth cycle, dry matter loss, age of the substrate at first fruiting, mean mushroom weight/yield (MMW), mean mushroom number (MMW), biological efficiency (B.E), bioconversion efficiency and mushroom quality of *Pleurotus osteratus var florida* grown on corn husk was evaluated., The data resulting from the experiment was analysed using means and percentage. *Pleurotus osteratus var florida* on corn husk had 50 % growth/colonization after 37 days of spawning. 3.5 % poultry waste was the first to produce fruit body after 40 days of inoculation (3 days after opening). The effects of different concentration of poultry wastes on the mean yield showed that there was no significant difference between them at (p=0.05). The highest mushroom quality (big) was obtained from 0 % poultry waste treatment, while the least quality (very small) was obtained from the corn husk that received 2.5 % poultry waste. The biological efficiency ranged from 2.25 - 2.50 %. Dry matter loss was in the range of 51.7-60 %. There was no significant difference when the different enrichment levels were compared with one another for the mushroom bioconversion efficiency. Corn husk has proved to be nutritionally strong enough to support the cultivation of *Pleurotus osteratus var florida* when enriched with poultry wastes as additive.

**Keywords:** ***Pleurotus osteratus var florida,*** **Corn, Husk, Poultry, Wastes, Additive,**

## Introduction.

In Nigeria and other developing countries of the world, tones of agricultural and domestic wastes are generated annually. The wastes are generally of no value to man except when integrated properly into crop production through soil enrichment. It further prevents them from constituting environmental hazards during their biodegradation. According to Madan *et al* .(1987) production of edible mushroom with agricultural waste such as rice husk, wheat offal, corn straw ,corn cob etc is a value added process to convert these materials which are otherwise considered waste into human food. It represents one of the most efficient biological ways by which these wastes can be recycled. Cultivation of *Pleurotus osteratus var florida* require a suitable substrate. A common substrate that has been in use by researchers in the past is sawdust (Adedokun *et al*.2003; Isikhuemhen and Lebauer 2004; Chiejina and Olufokunbi,2010). However, wood dust may have a long term hazardous effect on health (Meier ,*et al* 2013). Hence the need to try to cultivate *Pleurotus osteratus var florida* and other edible mushroom species on other abundantly available agricultural wastes which are generated annually. These large wastes constitute environmental problem by polluting the environment.. Since edible mushroom are adapted to grow on a variety of Lignocellulose materials, it is therefore possible to cultivate *Pleurotus osteratus var florida* on a wide variety of unconventional materials such as corn husk.

Corn husk is a residue from corn plant which is a highly available waste product in corn producing areas of Nigeria. It is rich in Lignin, cellulose and hemicelluloses. It is also a homogenous material in terms of its chemical and physical characteristics. When pressed, corn husk is porous enough to support the mycelia growth of *Pleurotus osteratus var florida* and can also facilitate the gas exchange of the substrate. Notwithstanding, basidiocarp production can be reduced in this material due to the shortage of nutrients. (Soto-Velazco *et al*.1991). Thus Enrichment of corn husk with nutrients such as poultry waste is desirable.

Poultry/chicken manure has two important functions in mushroom compost .First it's a cheap and fairly reliable source of nitrogen .In the past urea, ammonium sulphate, malt culm, cotton seed meal or materials containing protein were used, these materials were however more expensive. Secondly, poultry/chicken manure is bursting with decomposable carbohydrates. It contains various substances that ensure the temperature rises in the compost, trigger the composting process and supply nutrients for the necessary micro organisms. They also contain many bacteria and other micro organisms with beneficial effects on the composting process.

There is evidence to show that mushroom cultivation can be costly (Shroeder *et al.* 1970, and Boers,1991). Countries such as China, Japan and Taiwan have developed many methods of growing mushroom even with limited resources. Individuals and extension workers are now adapting available techniques to local circumstance (Oci, 1986). It is the realization of this that this research was set out to investigate the possibility of growing *Pleurotus osteratus var florida* on low cost, easily available agricultural waste like corn husk enriched with different concentrations of poultry waste. This when achieved will translate the present national interest in edible mushroom cultivation into practical reality.

## Materials and Methods

### Study site and Source of sample.

This research was conducted at the Dilomat Mushroom Farm located at the Rivers State University of Science and Technology, Port Harcourt, Rivers State Nigeria. Corn husk was obtained from commercial corn roosters within the University campus, while mushroom spawns established on guinea corn seed were obtained from Dilomat Mushroom Farm Port Harcourt.

### Sample Preparation.

Samples were prepared according to the modified method of Stamets (2000). Shredded and moistened corn husk were mixed with different concentrations of poultry wastes at 0, 1.5, 2.5 and 3.5 % on dry weight basis of the substrate. Two per cent lime ($CaCO_3$) was added to correct the pH of the substrate. The four concentrations of poultry waste which represented the treatments were replicated 3 times and composted for 2 weeks. 2 kg of the composted substrate was measured into high density polypropylene bags. The bags were packed inside a drum steamer and pasteurized for 3 hours and allowed to cool overnight before been inoculated with 3.5 % spawn of *Pleurotus osteratus var florida* grown on guinea corn seed. After inoculation, the substrates were incubated at (28-30$^0$C) in a specially constructed growth chamber with controlled atmosphere. After incubation, the bags were opened after 57 days of spawning and watered to induce fruit body production. They were harvested for a period of 28 days starting from 3 days after opening.

For the productivity evaluation, the following parameters were measured: Mean mushroom weight (w/w) (MMW), Mean Number of Mushroom (MNM), Growth Cycle (which was the period from spawning to the end of incubation), Biological Efficiency (B.E) was measured as the mushroom fresh weight per 100 g of substrate used. Bioconversion Efficiency was recorded as grams of dry mushroom produced per 100 g of dry substrate. Dry matter loss was recorded as the ratio of the substrate weight at the end of the production cycle in percent, Age of the substrate at first fruiting and mushroom quality were evaluated by sorting the different size groups and classified them as Pileus diameter above 13 cm as very big; 10-13 cm as big; 5-10 cm as medium; 2-5 cm as small and 0-2 cm as very small according to Elenwo *et al.(*2007).

The substrates were lightly watered everyday to induce fruiting. The production cycle for this study was 65 days.

### Experimental Design and Data analysis

The experiment was laid out in a completely randomized design. The data generated in this study were subjected to analysis of variance (ANOVA) Means were separated using Fishers Least Significant Difference at P=0.05.Means and percentages were according to the procedure outlined by Steel and Torrie, (1982).

## Results and discussion

The effect of different concentration of Poultry waste on the growth cycle, age at first fruiting, MMW, MNM, B.E, BCE, dry matter loss is presented in Table 1.

**Growth cycle:** *Pleurotus osteratus var florida* grown on corn husk had 50 % growth/colonization after 37 days of inoculation across all the enrichment levels (Table 1). This could be attributed to the relatively high moisture content of the growth medium during the composting period which may have hindered mycelia growth. This result is in agreement with Kleb's first principle which states that cessation of vigorous vegetative mycelia growth depends on either the exhaustion of nutrients or the accumulation of staling factors like excess moisture in the medium. This excess moisture which accumulated at the bottom of the polyethylene bags may have hindered the growth mycelia, however, mycelia growth resumed after incisions were made at the bottom of the bags. This resumed mycelia growth however delayed the production of the second flush.

**Age at first flush:** The first fruiting ages in days ranged from 40-51 after spawning. Fifteen percent poultry waste additive was the last to produce fruit bodies at 51 days after spawning. These values were statistically different indicating that addition of poultry waste to the substrate has the potential to influence fruit body production. This result is in agreement with Markson *et al*., (2012).

**Table 1: Effects of different concentrations of poultry waste on the growth cycle, age at first fruiting, MMW, MNM, B.E BCE, dry matter loss.**

| Concentrations of poultry waste (%) | Growth cycle (days) | Age at first fruiting (days) | MMW (g) | MNM | BE (%) | BCE (%) | Dry matter loss (%) |
|---|---|---|---|---|---|---|---|
| 0 | 37 | $41^a$ | $45^a$ | $6.6^a$ | $2.25^a$ | $0.28^a$ | $53.3^a$ |
| 1.5 | 37 | $51^b$ | $58.3^b$ | $7.3^a$ | $2.91^a$ | $0.27^a$ | $51.7^b$ |
| 2.5 | 37 | $41^a$ | $57.5^c$ | $19.5^b$ | $2.88^a$ | $0.34^a$ | $60.0^c$ |
| 3.5 | 37 | $40^a$ | $50.0^d$ | $11.3^c$ | $2.50^a$ | $0.29^a$ | $55.0^d$ |
| FLSD (p=0.05) | NS | 1.02 | 2.6 | 3.1 | NS | NS | 1.2 |

a -Mean values within the same column with common superscripts do not differ (P=0.05).

**Mean mushroom weight**: Mean mushroom weight/yields (w/w) (MMW) increased by 13.3 , 12.5, and 5 g at 1.5 and 2.5 and 3.5 % poultry waste additive levels when compared with the control respectively. The 1.5 % enrichment level proved superior to the 3.5% level by producing 8.3g more mushroom. Also 2.5% revealed 7.5g more mushroom when compared with 3.5% level of enrichment. This result is also in agreement with Uddin, *et al.,* (2011) and Markson *et al.,* (2012).This suggest that higher quantity of poultry waste (supplement) in the substrate do not translate to higher mean mushroom weight.

**The mean number of mushroom:** The mean numbers of mushroom fruit bodies increased by 0.7, 12.9 and 4.7 at 1.5, 2.5 and 3.5% respectively relative to the control. The highest mean difference of 13.9 by the corn husk that received 2.5% poultry waste enrichment level suggest that increasing the quantity of supplements / additives in the substrate do not necessarily increase the number of mushroom fruit bodies produced. This result is in agreement with the findings of Das *et al.* (1991) which state that variations in seasons seriously affect the number of mushroom fruit bodies produced. They reported that favorable temperature and moisture conditions enhanced the production of fruiting bodies of mushroom.

**Bioconversion efficiency**: The bioconversion efficiency of the different enrichment levels did not show any significant difference. The values were in the range of 0.27 to 0.34 %. The low biological efficiency and bioconversion efficiency could be attributed to low yield due to environmental factors such as humidity, temperature and moisture regime.

**Dry Matter Yield: T**he control recorded significantly higher value of dry matter loss relative to yield from the mushroom that was produced from the corn husk that received 1.5% poultry waste enrichment. This fact may have resulted from the increased moisture regime of the enriched corn husk. There were also significant dry matter increases of 5.7 and 1.7 from 2.5 and 3.5% additive levels respectively when compared with the control. Number and unit weight of mushroom was not found to be proportional to its dry matter loss. The high dry matter loss could be attributed to the relatively long period of incubation.

**Biological efficiency**: The biological efficiency of *Pleurotus osteratus var florida* on corn husk treated with different concentrations of poultry waste did not differ significantly when the treatments were compared with the control and when the different enrichment levels were compared with one another. Nevertheless the biological efficiencies of the different treatments ranged from 2.25-2.91%. The highest efficiency value was obtained from 1.5 % poultry waste while the least was recorded from the corn husk that received 0% enrichment of poultry waste. This result point to the fact high enrichment of corn husk substrate with poultry waste may not ensure high economics returns. This could be attributed to the short duration of the study which may have resulted in low insignificant biological efficiency. These results are in also in agreement with the findings of Markson *et al* (2012).

**Mushroom Size Groups:** The effect of different poultry waste enrichments on mushroom size distribution (i.e per cent number of different size groups) are presented in table 2.There was statistically significant difference in the size yield of the different poultry enrichments when the control was compared with the treatments and when the treatments were compared with one another The highest mushroom size (above 13 cm ) was only recorded from the corn husk substrate that received 3.5% poultry waste enrichment, while the control recorded the largest number of small sized group (sizes between 2-5cm ).Furthermore largest quantity of mushroom that measured 0-2cm (ie very small) was produced by the corn husk that received 2.5% poultry waste enrichment. These results are in agreement with the findings of Markson *et al.*(2012).

**Table 2. Effects of the different concentrations of poultry waste on the mushroom quality evaluated by different size groups (% of number of harvested mushroom)**

| **Concentration of poultry waste (%)** | **Different Size groups** Very big (above 13cm) | Big (10-13cm) | Medium (5-10 cm) | Small (2-5 cm) | Very small (0-2cm) |
|---|---|---|---|---|---|
| 0 | 0.0 | $19.7^{a}$ | $9.0^{a}$ | $39.4^{a}$ | $15.2^{a}$ |
| 1.5 | 0.0 | 27.4b | $17.6^{b}$ | $31.5^{b}$ | $17.8^{b}$ |
| 2.5 | 0.0 | 5.1c | 11.8c | $23.6^{c}$ | $25.6^{c}$ |
| 3.5 | 2.7 | 8.8d | 46.9d | $17.7^{d}$ | $20.4^{d}$ |
| FLSD(p=0.05) | 1.0 | 2.0 | 1.2 | 2.1 | 1.89 |

Mean values within the same column with the same superscript do not differ significantly.

## CONCLUSION

This research found out that *Pleurotus osteratus var florida* can be grown on corn husk with the addition of poultry waste as nutritional supplement. The best level of the poultry waste for large and medium sized mushroom was 3.5%, while the best level of the poultry waste for large quantity small sized mushroom was at the 0 %. A high moisture content of the compost above 70 %, hinders mycelia growth. The different concentrations of poultry waste have no effect on the biological efficiency, bioconversion efficiency and dry matter loss. However, the longer the production cycle, the higher the dry matter loss. The *Pleurotus osteratus var florida* can easily be used to recycle the huge amounts of corn husk generated during the corn season in an environmentally friendly manner.

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