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GROWTH PERFORMANCE, PROXIMATE AND MINERAL ASSAY OF PLEUROTUS TUBER-REGIUM (FR.) SING MUSHROOM GROWN IN IMO STATE POLYTECHNIC FARMLAND SUPPLEMENTED WITH PIG AND POULTRY DUNGS

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Abstract
The cultivation of Pleurotus tuber regium in an open farmland are rarely common, hence this pilot study assayed the growth performance, proximate and mineral assay of Pleurotus tuber-regium (Fr.) Sing mushroom grown using its sclerotia in Imo State Polytechnic farmland supplemented with pig and poultry(birds) dungs. The results (Figure 1 and Table 1) indicated that the pig (A) and poultry (B) dungs supported the growth more favourably than the farmland (C) alone with comparable nutritional values. While the Table 2 showed that the mushrooms from this pilot study were rich in mineral contents. The results from this study underscored that the Polytechnic farmland as well as its pig and poultry dungs supplemented, supported favourable growth and yield with appreciable nutritional values.

Keywords: *Mushroom, dung, growth, yield, supplement*

INTRODUCTION

Mushrooms are fleshly spore bearing fruiting bodies of fungi that grows in forest and farmlands after rain. The forest and farmlands where they grow contains substance (substrate) like logs of wood, decomposing agro-waste, animal waste and soil that support its growth. They obtain nutrients from these substrates through external digestion and absorption by mycelium (Adebiyi, *et al*., 2016).

The medicinal and nutritive values of mushrooms are well reported (Cheung and Cheung, 2005; Akinyele, *et al*, 2011).

There are many varieties of mushroom of which *Pleurotus tuber-regium* is one of them. *Pleurotus tuber-regium* (Fr) Singer is an edible mushroom that is found growing in the tropical and sun-tropical region of the world (Zoberi, 1973). It's a widespread mushroom in Nigeria's southern regions, producing huge spherical to ovoid sclerotia that can reach 30cm in diameter (Oso, 1975). Sclerotia is a type of sclerotia. The sclerotia and the mushroom are eaten in Nigeria. The sclerotia are used in various soups and medicinal preparations both for human consumption and in traditional medical practice in Nigeria (Zoberi, 1973; Oso, 1975). The mushroom when matured, the cap curves upwards to form a cup-like shape. The sclerotium is often formed underground in form of tuber during unfriendly environmental conditions. Nutritinally mushrooms are very rich in proteins, carbohydrates, minerals and vitamins (Adebiyi, *et al*, 2016). Onuoha and Obi-Adumnya (2010) reported the nutritional composition of *Pleurotus tuber regium* (mushroom) grown in various substrate. The growth of the fungus with relative ease in the laboratory is well reported and it's known for its quick development and ability to cause severe wood degradation (Okhuoya and Harvey 1984). *Pleurotus tuber-regium* cultivation or farming is coming in the laboratory unlike cultivating it directly on a farmland. Therefore this pilot study was aimed at cultivating this mushroom in an open farmland using Imo State Polytechnic, Umuagwo farmland as a trial.

MATERIALS AND METHODS

The Sclerotia Acquisition

The sclerotia of *P. tuber-regium* were obtained from Relief market, Owerri North L.G.A., Imo State, Nigeria. It was appropriately identified by a mycologist Mrs

Amarachi ObiAdumanaya, from forestry department of Ministry of Agriculture, Imo State Local Government Civil Service Commission.

Farmland Preparation

The mapped out farmland (½ a plot) (which is a mixture of humus & sandy soils) was prepared and gotten ready for the pilot using hired labourers.

The farmland was divided into three segments: segment **A** (farmland supplemented with pig dungs), segment **B** (farmland supplemented with poultry/birds dungs) and segment **C** (farmland without any supplementation as control) respectively.

The Sclerotia Preparation and Planting

The healthy sclerotia were soaked in clean water over night prior to planting. It was cut to size of 2cm by 4cm and planted 1 cm deep and 30 cm apart in a well aerated prepared farmland.

CHEMICAL ANALYSIS

The mushrooms (samples A, B & C) were harvested and dried at room temperature. A portion of the dried mushrooms were ground to fine powder using a blender and then stored in air-tight bags at room temperature until analysis.

Proximate Assay

The samples were analyzed for moisture, protein, fat, ash and fiber by the methods of AOAC (2000). Carbohydrate was analyzed by difference. In line with the AOAC (2000), total organic nitrogen, fat, ash, and fiber were subtracted from total dry matter.

Minerals Determination: Mineral contents of the samples were determined by the method described by AOAC (2000); Sodium (Na^+) and potassium (K^+) ions contents were determined by flame photometry as described by Onwuka (2005). Other metal contents (Zn, Fe, Cu, and Se) were determined using Onwuka's atomic absorption spectrophotometric method (2005).

RESULT AND DISCUSSION

Table 1.: The Results of the proximate assay (dry weight) of the mushroom from the *Pleurotus tuber regium* mushroom

	Proximate Analysis Values					
	Moisture %	Ash %	Fat %	Fibre %	Protein %	Carbohydrate %
A	3.78	16.20	2.79	9.29	21.42	47.18
B	3.95	16.31	2.68	10.08	22.07	44.90
C	3.64	15.72	2.51	9.22	21.59	47.33

Sample A: Mushroom from the farmland supplemented with Pig dung (mixture of soil & pig dungs)

Sample B: Mushroom from the farmland supplemented with Poultry dung (mixture of soil & birds dung)

Sample C: Mushroom from the farmland (soil) alone (control)

Table 2: The Results of the Mineral composition (dry weight) of the mushroom from the *Pleurotus tuber-regium* mushroom

Samples	Minerals levels							
	Iron mg/kg	Zinc mg/kg	Copper mg/kg	Selenium mg/kg	Sodium mg/kg	Potassium mg/kg	Calcium mg/kg	Phosphorous mg/kg
A	8.04	9.22	3.16	68.84	392.32	6.06	163.75	2.05
B	6.97	8.88	4.09	66.54	331.66	8.19	171.06	2.55
C	7.21	8.92	3.95	65.95	342.72	7.65	171.11	2.15

Sample A: Mushroom from the farmland supplemented with Pig dung (mixture of soil & pig dungs)

Sample B: Mushroom from the farmland supplemented with Poultry dung (mixture of soil & birds dung)

Sample C: Mushroom from the farmland (soil) alone (control)

Figure 1: The mapped out farmland with the growing mushroom barricaded from

Figure 2a:Sample of the growing mushroom in the

Figure 2b: The harvested mushrooms

Figure 2c few mushrooms harvested from the Farmland alone

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Highest fresh mushroom yield were seen on pig and poultry dungs supplemented farmland (A & B) compared to the non-supplemented farmland (C) (Figure 2a-2c.). This could be as a result of nutrient enhancement because of the animal dungs (Table 1.1) (Okhuoya and Okogbo, 1991).

A mixture of pig/poultry droppings and farmland (soil) produced the more fruitbodies (Figure 1 & 2).that were comparable to Onuoha and Obi-Adumanya, (2010); Stanley & Odu (2012) reports. Chang and Buswell (1996) claimed that the nutritional composition of substrates influences the production of fruitbodies. Also, according to Zadrazil (1980), the growth of Pleurotus species is favored on substrates with low nitrogen content, i.e., a higher carbon-to-nitrogen ratio to raise good yield. It was observed in this study that the mixture of poultry and pig dropping contains the necessary nutrients required for fruitification of *Pleurotus tuber regium*. This could be based on the observation that fruitbodies produced on a mixture of poultry/pig droppings and farmland (soil) were significantly more in number and larger in size than those from the farmland alone (Figure 1).

The Table 1 showed that the proximate values of the mushroom from the poultry and pig supplemented farmland were comparable to the non-supplemented farmland.

Mushrooms have a high moisture content, which explains why they have such a short shelf life if no preservatives are applied after harvest, even if they grow tough and almost leathery when harvested at full maturity (Fasidi and Kadiri, 1993). The moisture contents of the worked were lower than the ones reported by Ijeh *et al*, (2009); Onuoha and Obi-Adumanya, (2010).

The ash contents of the samples were fairly high indicating its relatively high mineral content. While the ash contents were higher than values obtained by Ijeh, *et al*., (2009), Onuoha and Obi-Adumanya, (2010).

The crude protein obtained (Table 1) were comparable even with the values reported by Ijeh, *et al* (2009), higher than Onuoha and Obi-Adumanya, (2010) and lower than the values reported by Adebiyi, *et al*, (2016) in an edible mushroom called *Termitomyces robustus.* The crude protein content (21.42-22.07 %) obtained in this study were high when compared with the previous works of Ogundana and Fagade (1982) and Kadiri and Fasidi (1990) who obtained 14.6% for the cap of *P. tuber regium*

Mushrooms are valuable sources of dietary fibre (Chandravadana, *et al*, 2005). The fibre in diet aids bowel movements thereby reducing constipation and reduces colon cancer.

The fibre contents \(Table 1) obtained in the works are comparable with the ones reported by Ijeh *et al*, (2009), Adebiyi,*et al*, (2016) in one of his analysis on edible mushroom. But higher than the values obtained by Onuoha and Obi-Adumanya, (2010).

Breene (1990) reported that fresh mushrooms usually contain less fat, the amount being 1-8% of dry weight. The values obtained in this work agreed with the Breene (1990); Onuoha and Obi-Adumanya, (2010).reports. In view of the low fat content recorded in this study, *P. terber-regium* will be suitable as a component of weight restricted diet (Adebiyi, *et al*, 2016)..

Available carbohydrates are the second major nutrient component of mushroom, amounting to an average of 4.2% (Fakushima, 2000). In the present study, available carbohydrate content was 44.90-47.18%. This values were lower than the values obtained by Ijeh, *et al*, 2009, Onuoha and Obi-Adumanya, (2010), but higher than the reported value of 26.59 % by Adebiyi, *et al*, (2016) The results (Table 2) obtained from this study indicates that the mushrooms are rich in minerals. Iron, zinc, copper, selenium, sodium, potassium, calcium and phosphorous contents of the mushroom obtained from the farmlands (A, B, & C) were comparable. The results were higher than that obtained by Ijeh, *et al*., (2009)..This underscores the richness of the farmland to support farming even that of mushroom using the sclerotia of Pleurotus *tuber regium*.

Edible mushrooms, according to Vetter (1990), include a variety of minerals, both macro and micronutrients, as well as non-essential trace elements. Mushroom species' ability to bio-accumulate minerals from the growing media into the fruiting body has been widely documented. (Kalac, 2009).

Generally, minerals are essential for the growth, development, maintenance and repair of the body.
These minerals are important for maintaining osmotic pressure and hence regulating the exchange of water and solutes inside the body. They aid in the transmission of nerve impulses and muscle contractions, as well as maintaining the body's acid-base balance (Adebiyi, *et al*, 2016). Potassium is required for glycogen and protein synthesis, as well as glucose metabolic breakdown.

Magnesium is used to activate various key enzyme systems, like kinases and is an essential component of bone, cartilage and exoskeleton. Phospholipids, nucleic acids, and a number of essential enzymes that play a role in energy and cell metabolism all contain phosphorus (Adebiyi, *et al*, 2016).

Mushroom eaters are more likely than non-mushroom eaters to fulfill the recommended daily allowance (RDA), daily recommended intake (DRI), fiber, and protein for calcium, copper, iron, magnesium, phosphorus, zinc, folate, niacin, riboflavin, thiamin, vitamin A, B_6, B_{12}, C, E, energy, and carbohydrate (Zahid, *et al*., 2010). Thus they have a better nutrient profile than do those who do not eat mushrooms (Stamets, 2000). Edible mushrooms, whether fresh, cooked, or processed, are a nutritious and tasty food source for the majority of people, and can constitute a substantial dietary component for vegetarians (Breene, 1990). The nutritional value of edible mushrooms compares favourably to that of most vegetables. The nutrient content of a single mushroom species varies greatly depending on habitat, growing medium, and post-harvest processing processes. Consumption of whole medicinal and edible mushrooms on a regular basis may provide a functional or therapeutic benefit to an individual's diet.

CONCLUSIONS

The results from this study underscored that the Polytechnic farmland as well as its pig and poultry dungs supplemented, supported favourable growth and yield with appreciable nutritional values

With the findings of this pilot study and appropriate technical knowledge, mushroom farming especially *P. tuber regium* in order to produce them in large quantity so as to make them available for food, medicine, and as a research tool in the nation.

Conflict of interest: None

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