

Bagged Production and Return on Investment of Various Mushroom Strains Using Sawdust Media under 18.9⁰C to 31⁰C Temperature

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Abstract: The study was conducted at Mushroom Research Center (MRC), College of Agriculture, Mindanao State University, Marawi City to determine the growth and yield performance of mushroom using sawdust as a basal substrate for cultivation. In particular, the study aimed to evaluate the diameter of basidiocarp, length of the stipe of basidiocarp, yield per bag (measured in gram), and Return on Investment (ROI). The experiment was laid out in Completely Randomized Design (CRD) with four (4) treatments and replicated three (3) times. The Treatments were: Treatment (T₁) *Pleurotus florida*, Treatment (T₂) *Pleurotus ostreatus*, Treatment (T₃) *Ganoderma lucidum*, and Treatment (T₄) *Calocybe indica*. Results of the study showed that *P. ostreatus* had higher diameter, width, yield and ROI. However, it was found comparable with *P. florida*. Hence, these two mushroom varieties were recommended under Mindanao State University Marawi City condition with 18.9°C to 31°C temperature.

Keywords: *Pleurotus florida*, *Pleurotus ostreatus*, *Ganoderma lucidum*, *Calocybe indica*

1. Introduction

Mushroom is known for its nutritive value, aside from its defined medicinal worth, for most of the Filipino consumers. The demand of mushroom in the market increases as people develop their awareness on the commodity's health benefits. However, mushroom production is still trivial to farmers. Hence, there is a need to determine and identify varieties appropriate in a specific temperature to meet the demand in the marketplace.

Man has been hunting for the wild mushrooms since antiquity [14]. Thousands of years ago, fructifications of higher fungi have been used as a source of food [35] due to their chemical composition which is attractive from the nutrition point of view. During the early days of civilization, mushrooms were consumed mainly for their palatability and unique flavors [43]- [44]. Present use of mushrooms is totally different from traditional because, lot of research has been done on the chemical composition of mushrooms, which revealed that mushrooms can be used as a diet to combat diseases. The early history regarding the use of mushrooms in different countries has been reviewed by number of workers [20]. [7] determined the nutritive value of *Pleurotus flabellatus* as 0.974% ash, 1.084% crude fibre, 0.105% fat, 90.95% moisture, 0.14% non-protein nitrogen and 2.75% protein.

[4] suggested that food value of mushrooms lies between meat and vegetables. [15] observed that mushrooms in general contain 90% water and 10% dry matter. More so, the protein content varies between 27 and 48%. Carbohydrates are less than 60% and lipids are between 2 to 8%. [41] indicated that an average mushroom is about 16.5% dry matter out of which 7.4% is crude fibre, 14.6% is crude protein and 4.48% is fat and oil. [19] indicated that edible

mushrooms were highly nutritional and compared favourably with meat, egg and milk food sources. Of several thousand mushroom species known worldwide, only around 2000 are considered edible, of which about 20 are cultivated commercially with only 4 to 5 under industrial production [10]. There is also a significant difference in the nutrient contents of pileus versus stalks [27], [58].

Mushroom is indeed a package commodity apt for people with nutritional absences and health issues. Hence, the need to introduce a comparative study of various mushroom varieties to determine which will yield high and becomes profitable is a requisite for farmers' increased production.

2. Literature Review

Carbohydrates

The carbohydrate content of mushrooms represents the bulk of fruiting bodies accounting for 50 to 65% on dry weight basis. Free sugars amount to about 11%. [18] reported that *Coprinus atramentarius* (Bull.: Fr.) Fr. contain 24% carbohydrate on dry weight basis. The mannitol, also called as mushroom sugar constitutes about 80% of the total free sugars, hence it is dominant [52], [54]. Raffinose, sucrose, glucose, fructose and xylose are dominant in it [50]. Water soluble polysaccharides of mushrooms are antitumor [57].

Fats

In mushrooms, the fat content is very low as compared to carbohydrates and proteins. The fats present in mushroom fruiting bodies are dominated by unsaturated fatty acids. [49] determined the fat content of some mushrooms as 2.04% in *Suillus granulatus*, 3.66% in *Suillus luteus* and 2.32% in *A. campestris*. [21] observed that mushrooms are rich in linolenic acid which is an essential fatty acid. Total fat content in *A. bisporus* was reported to be 1.66 to 2.2/100

g on dry weight basis [30]. [40] indicated that mushrooms have 4.481% fats on dry weight basis. [25] has reported a fat content of 11.52% in the *Amanita ceasarea* fruiting bodies on dry weight basis. In 100 g fresh matter of *A. bisporus* (Lange) Sing and *Pleurotus ostreatus* (Jacq: Fr.) Kumm, the content of fatty compounds was found to be 0.3 and 0.4 g respectively [33], but on dry weight basis, it is 2 and 1.8 g respectively [48]. [2], [33], [46] and [34] worked on the fibre content of different mushrooms. Mushrooms are considered good source of fats and minerals [23]. [56] and [42] reported that fat fraction in mushrooms is mainly composed of unsaturated fatty acids.

Mineral Constituents

The fruiting bodies of mushrooms are characterized by a high level of well assimilated mineral elements. Major mineral constituents in mushrooms are K, P, Na, Ca, Mg and elements like Cu, Zn, Fe, Mo, Cd form minor constituents [6], [5], [13]. K, P, Na and Mg constitute about 56 to 70% of the total ash content of the mushrooms [28] while potassium alone forms 45% of the total ash. [1] found that content of potassium and sodium in *A. bisporus* was 300 and 28.2 ppm. respectively. *A. bisporus* ash analysis showed high amount of K, P, Cu and Fe [3]. [26] reported that *M. esculenta* contains Ca (0.5776 mg), P (3.313 mg), Fe (1.213 mg) and K (3.831 mg). [53] reported that *A. bisporus* contains Ca (0.04 g), Mg (0.16), P (0.75 g), Fe (7.8 g), Cu (9.4 mg), Mn (0.833 mg) and Zn (8.6 mg) per kilogram fresh weight. Mushrooms have been found to accumulate heavy metals like cadmium, lead, arsenic, copper, nickel, silver, chromium and mercury [47],[39], [55], [24], [51], [22], [31]. The mineral proportions vary according to the species, age and the diameter of the fruiting body. It also depends upon the type of the substratum [16]. The mineral content of wild edible mushrooms has been found higher than cultivated ones [35], [45].

Vitamins

Mushrooms are one of the best sources of vitamins especially Vitamin B [9], [37], [59], [11], [38]. Vitamin content of edible mushrooms has been reported by [17], [8] and [29]. [32] gave a comprehensive data of vitamin content of mushrooms and some vegetables. According [37], wild mushrooms contains much higher amounts of vitamin D2 than dark cultivated *A. bisporus*. Mushrooms also contain vitamin C in small amounts [36] which are poor in vitamins A, D, and E [3].

3. Materials and Methods

3.1 Research Design

The experiment was laid out using Completely Randomized Design (CRD) with four treatments. Each treatment was replicated three (3) times. There were four (4) varieties of mushroom used in the study such as *Pleurotus florida*, *Pleurotus ostreatus*, *Ganoderma lucidum*, and *Calocybe indica*. Randomization was done through drawing of lots. Shown below are the treatments.

Table 1: Treatments

Treatments	Description
T ₁	<i>Pleurotus florida</i>
T ₂	<i>Pleurotus ostreatus</i>
T ₃	<i>Ganoderma lucidum</i>
T ₄	<i>Calocybe indica</i>

*Treatment (T)

3.2 Materials

The following materials were used in this study: sorghum (*Sorghum bicolor*), flat bottles, mother spawn of the four strains of mushroom, sawdust, limestone, rice bran, polyethylene bags, rubber, cotton, paper, alcohol lamp, and denatured alcohol.

3.3 Cultural Management

3.3.1 Washing and Sterilization

During the experimental work, flat bottles were used. The glassware prior to use was washed with water and detergent powder followed by rinsing with tap water. The glasswares were dried and sterilized in pressure cooker for 30 minutes. The inoculation needle, knife, scissors, and blades were sterilized by dipping them in 70% alcohol followed by heating over flame.

3.3.2 Preparation of Grain Spawn

Mother spawn was prepared from pure culture of four strains (T₁, T₂, T₃, T₄) of mushroom. Grains were used as substrate for preparation of mother spawn. Clean healthy and bold grains were taken but broken and undersized grains were discarded then these were thoroughly washed in clean water three times to remove chaffs, dust, and other particles and dipped in water for 30 minutes. The excess water was drained and grains were spread on clean cloth so that excess moisture can be eliminated. Total of 50 g of sorghum grains (*Sorghum bicolor*) were put into spawn bottles. About 2/3 of each spawn bottle were filled with grains and plugged with cotton, cover with aluminum foil and tied with rubber band after they were sterilized in pressure cooker for 30 minutes. The grains in the bottles were then inoculated with Mushroom Strains of (*Pleurotus florida*) T₁, (*Pleurotus ostreatus*) T₂, (*Ganoderma lucidum*) T₃ and (*Calocybe indica*) T₄ under aseptic condition. After cooling, inoculation was done with active growing mycelium of four strains of mushroom then incubated at mushroom shed till the mycelium covered the entire grain surface. The spawn was prepared by this way called as mother spawn and prepared in sufficient quantity required for the proposed research work. For all kinds of studies mother spawn was multiplied on wheat grains in similar way as described for mother spawn

3.3.3 Preparation of Sawdust Substrate

To prepare the compost, sawdust was used as basal substrates. The sawdust material was bought from Saguarian, Lanao del Sur. The preparation of the substrate started with the physical removal of impurities like chips of wood, plastics, leaves of plants, and other organic substances that might cause contamination. Afterwards, sawdust was prepared by mixing 75 kilos of sawdust, 15 kilos of rice bran, ½ kilo of lime limestone, 1 kilo of brown sugar. Mix manually using shovels until a light change in

color of substrate materials is observed. Stirring should be continued until no lumps of rice bran found and then water was added to moistens the mixture, then covered with plastic for one-month efficient fermentation.

The Sawdust substrate was prepared by air drying on clean concrete floor for one hour. After this period of exposure, the sawdust material was moistened with water for at least 75% moisture content. This can be determined by squeezing the wet substrate by hand and when little water coming out in between fingers and it approximately 75% moisture content. After which, the composted substrates will be placed into heat resistant polypropylene bags (6x12 x 02) containing 600 g per bags. The content of the bags will be compacted using fist. Then, the bags will be covered and plugged with cotton and rubber band.

3.3.4 Sterilization of the Bagged Substrate

After sawdust substrate, filled bags were sterilized using drum (33.5x42.5x73.0 inches in size) for two hours and cooled down for 24 hours. Prior to spawning, the mushroom substrate has to undergo a disinfection process to prevent different pathogens (bacteria, molds or pests) affecting the mushroom development and yield. Killing competitive fungi will permit faster, better and more uniform spawning and will assure better resistance to future infections.

3.3.5 Inoculation and Incubation of the Bagged Substrate

The sterilized bags were inoculated aseptically with the prepared spawn according to treatments. Flat bottles containing the spawn were agitated well to separate the seeds. The seeds will be removed aseptically by flaming the mouth of the bottle containing the grain spawn. Around 15-20 grains were poured into the substrate bags. Following the same procedure, the newly inoculated bags were slightly tilted to distribute the mycelium coated grains on the shoulder area of the substrates bag around the neck. When inoculation is done, the bags are then mark with the species used accordingly.

After the inoculation, the bags are then stored in a room with indirect sunlight with a temperature of 26°C for incubation. As soon as the mycelia growth has covered the whole substrates, the bags were transferred into mushroom house.

3.3.6 Harvesting

Three to four days after opening the bagged substrates, mushroom primordial started to form and developed into fully matured basidiocarps. These basidiocarps were ready for harvesting in another two more days. When harvesting, the stalks of individual basidiocarps were gently pulled out from the bagged substrates.

The cultivation room and the medium substrates were maintained at humidity by regularly spraying of water twice a day. Pin heads and the fruiting bodies were harvested at the right stage and the bags were maintained for second, third, fourth cropping as long as mycelia still appears in each treatment.

3.4 Data Gathering Procedures

3.4.1 Growth Performance of the Bag Substrate

This was recorded by counting the days taken from spawning to the appearance of pinhead in substrate.

3.4.2 Length of the Stipe (cm). This was taken by measuring the length of the stipe using a ruler or tape measurement.

3.4.3 Diameter of the Basidiocarp (cm). This was determined by measuring the cross section of the basidiocarp or the cap of the basidiocarp.

3.4.4 Yield per bag (g). This was recorded by weighing all the marketable basidiocarp harvested per treatment for 15 consecutive days.

3.4.5 Return on Investment. This was taken using the formula:

$$(\text{ROI}) = \frac{\text{Net Income}}{\text{Cost of Production}} \times 100$$

3.5 Data Analysis

3.5.1 Analysis of Variance (ANOVA) for Completely Randomized Design (CRD) were used as tool in determining the results of the study.

3.5.2 Duncan's Multiple Range Test (DMRT) were used to compare the significant differences among treatment means.

3.5.3 Profitability Using Return on Investment (ROI). This included all the inputs used for the study. Using the formula, ROI was calculated:

$$\text{Return on Investment (ROI)} = \frac{\text{Net Income}}{\text{Cost of Production}} \times 100$$

4. Results and Discussion

4.1 Diameter of Basidiocarp

The diameter of basidiocarp of the four varieties of edible mushroom from Day 1 to Day 15 is presented in Figure 2. At Day 1 the highest mean diameter was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 9.81 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with a mean of 7.10 cm and 5.77 cm, respectively. However, the lowest mean diameter was attained by T₃ (*Ganoderma lucidum*) with a mean of 3.76 cm. At Day 2, T₂ (*Pleurotus ostreatus*) obtained the highest mean diameter with 10.49 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) having the mean diameter of 8.44 cm and 5.75 cm respectively. T₃ (*Ganoderma lucidum*) attained the lowest mean diameter with 3.71 cm. At Day 3, the highest mean diameter was obtained by T₂ (*Pleurotus ostreatus*) having the value of 9.94 cm. It was followed by T₁ (*Pleurotus florida*) with 6.95 cm. followed by T₄ (*Calocybe indica*) with 4.73 cm and T₃ (*Ganoderma lucidum*) attained the lowest mean diameter with 3.35 cm. Day 4, the highest mean diameter was obtained by T₂ (*Pleurotus ostreatus*) having the value of 9.33 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with 7.59 cm and 5.53 cm, respectively. T₃ (*Ganoderma lucidum*) was the lowest with 3.54 cm.

At Day 5, the highest mean diameter was obtained by T₂ (*Pleurotus ostreatus*) having the value of 9.96 cm. It was followed by T₁ (*Pleurotus florida*) with 6.99 cm. Next was T₄ (*Calocybe indica*) with 5.94 cm and lowest was T₃ (*Ganoderma lucidum*) with 3.67 cm. At Day 6, the highest mean diameter was obtained by T₂ (*Pleurotus ostreatus*) having the value of 9.39 cm. It was followed by T₁ (*Pleurotus florida*) with 7.60 cm. However, T₄ (*Calocybe indica*) had 4.83 cm and T₃ (*Ganoderma lucidum*) had the lowest mean diameter with 3.63 cm.

At Day 7, the highest mean diameter was obtained by T₂ (*Pleurotus ostreatus*) having the value of 9.78 cm. It was followed by T₁ (*Pleurotus florida*) with 8.25 cm followed by T₄ (*Calocybe indica*) with 7.19 cm. T₃ (*Ganoderma lucidum*) had the lowest with 3.20 cm. At Day 8, the highest mean diameter was obtained by T₂ (*Pleurotus ostreatus*) having the value of 9.30 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with 7.93 cm and 6.00 cm, respectively. T₃ (*Ganoderma lucidum*) attained the lowest mean diameter with 3.59 cm. At Day 9, the highest mean diameter was obtained by T₂ (*Pleurotus ostreatus*) having the value of 9.07 cm. It was followed by T₁ (*Pleurotus florida*) with 7.77 cm, followed by T₄ (*Calocybe indica*) with 6.03 cm. T₃ (*Ganoderma lucidum*) was the lowest mean diameter of 3.36 cm.

While at Day 10, the highest mean diameter was obtained by T₂ (*Pleurotus ostreatus*) having the value of 9.65 cm. It was followed by T₁ (*Pleurotus florida*) with 7.77 cm and followed by T₄ (*Calocybe indica*) with 5.84 cm. T₃ (*Ganoderma lucidum*) attained the lowest mean diameter with 3.17 cm. At Day 11, T₂ (*Pleurotus ostreatus*) obtained the highest mean diameter with 9.64 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) having the mean diameter of 7.13 cm and 6.73 cm respectively. T₃ (*Ganoderma lucidum*) attained the lowest mean diameter with 3.27 cm.

For Day 12, the highest mean diameter was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 10.24 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with a mean of 7.25 cm and 4.77 cm, respectively. However, the lowest mean diameter was attained by T₃ (*Ganoderma lucidum*) with a mean of 3.43 cm.

At Day 13, T₂ (*Pleurotus ostreatus*) obtained the highest mean diameter with 9.43 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) having the mean diameter of 2.87 cm and 4.97 cm respectively. T₃ (*Ganoderma lucidum*) attained the lowest mean diameter with 3.37 cm. For Day 14, the highest mean diameter was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 9.61 cm. It was followed by T₂ (*Pleurotus ostreatus*) with 7.11 cm, followed by T₄ (*Calocybe indica*) with 4.25 cm, the lowest was V3 (*Ganoderma lucidum*) with 3.41 cm.

Finally, at Day 15, T₂ (*Pleurotus ostreatus*) obtained the highest mean diameter with 9.63 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) having the mean diameter of 7.81 cm and 5.17 cm, respectively. T₃ (*Ganoderma lucidum*) attained the lowest mean diameter with 3.51 cm.

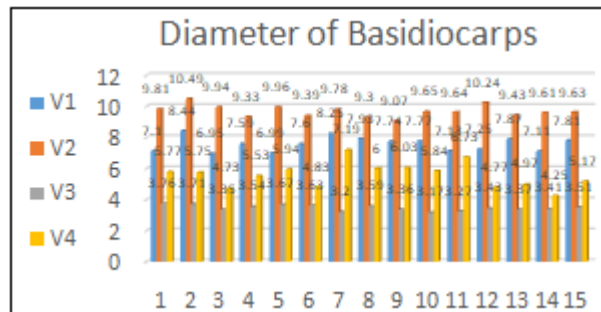


Figure 2: Effect of Sawdust on the Width of Mycelia (cm/day) of the Four Varieties of Mushroom for 15 days

4.2 Length of the Stipe of Basidiocarp

The Length of stipe of the Basidiocarp of the four varieties of mushroom from Day 1 to Day 15 is presented in Figure 3. At Day 1 the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 7.35 cm. It was followed by T₁ (*Pleurotus florida*) and T₃ (*Ganoderma lucidum*) with a mean of 5.25 cm and 5.09 cm, respectively. However, the lowest mean length was attained by T₄ (*Calocybe indica*) with a mean of 4.97 cm. At Day 2, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 6.84 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with a mean of 5.47 cm and 5.36 cm, respectively. However, the lowest mean length was attained by T₃ (*Ganoderma lucidum*) with a mean of 5.03 cm.

At Day 3, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 6.62 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with a mean of 5.24 cm and 5.03 cm, respectively. However, the lowest mean length was attained by T₃ (*Ganoderma lucidum*) with a mean of 4.69 cm. At Day 4, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 6.41 cm. It was followed by T₁ (*Pleurotus florida*) and T₃ (*Ganoderma lucidum*) with a mean of 5.00 cm and 4.62 cm, respectively. However, the lowest mean length was attained by T₄ (*Calocybe indica*) with a mean of 4.57 cm.

At Day 5, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 6.98 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with a mean of 5.46 cm and 5.08 cm, respectively. However, the lowest mean length was attained by T₃ (*Ganoderma lucidum*) with a mean of 4.85 cm. At Day 6, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 6.56 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with a mean of 5.49 cm and 5.05 cm, respectively. However, the lowest mean length was attained by T₃ (*Ganoderma lucidum*) with a mean of 4.95 cm.

At Day 7, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 6.87 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with a mean of 5.35 cm and 5.19 cm, respectively. However, the lowest mean length was attained by T₃ (*Ganoderma lucidum*) with a mean of 5.05 cm. At Day 8, the highest mean length was obtained by T₂ (*Pleurotus*

ostreatus) having the mean value of 6.51 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with a mean of 5.57 cm and 5.24 cm, respectively. However, the lowest mean length was attained by T₃ (*Ganoderma lucidum*) with a mean of 5.21 cm.

At Day 9, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 5.87 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with a mean of 5.23 cm and 5.06 cm, respectively. However, the lowest mean length was attained by T₃ (*Ganoderma lucidum*) with a mean of 4.81 cm. At Day 10, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 6.41 cm. It was followed by T₁ (*Pleurotus florida*) and T₃ (*Ganoderma lucidum*) with a mean of 5.00 cm and 4.62 cm, respectively. However, the lowest mean length was attained by T₄ (*Calocybe indica*) with a mean of 4.57 cm. At Day 11, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 6.30 cm. It was followed by T₁ (*Pleurotus florida*) and T₃ (*Ganoderma lucidum*) with a mean of 5.09 cm and 4.82 cm, respectively. However, the lowest mean length was attained by T₄ (*Calocybe indica*) with a mean of 4.81 cm.

At Day 12, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 6.85 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with a mean of 5.19 cm and 5.23 cm, respectively. However, the lowest mean length was attained by T₃ (*Ganoderma lucidum*) with a mean of 4.91 cm. At Day 13, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 6.57 cm. It was followed by T₄ (*Calocybe indica*) with a mean length of 4.95 cm. Next was T₁ (*Pleurotus florida*) with 4.19 cm and lastly was T₃ (*Ganoderma lucidum*) attained the lowest mean length with 4.54 cm. At Day 14, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 6.29 cm. It was followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with a mean of 5.02 cm and 5.04 cm, respectively. However, the lowest mean length was attained by T₃ (*Ganoderma lucidum*) with a mean of 4.79 cm.

At Day 15, the highest mean length was obtained by T₂ (*Pleurotus ostreatus*) having the mean value of 6.75 cm. It was followed by T₃ (*Ganoderma lucidum*) with 5.11 cm. It was followed by T₁ (*Pleurotus florida*) with 5.09 cm while T₄ (*Calocybe indica*) attained the lowest mean length with 4.90 cm.

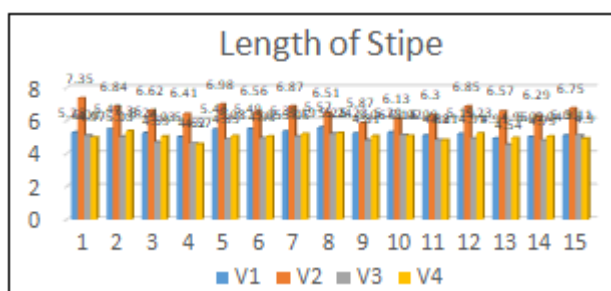


Figure 3: Effect of Sawdust on the Length of the Stipe of Basidiocarp (cm/day) of the Four Varieties of Mushroom for 15 days

4.3 Yield/Bag (g)

The yield per bag (g) of the four varieties of edible mushroom from Day 1 to Day 15 is presented in Figure 3. At Day 1, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 56.67 g. It is followed by T₄ (*Calocybe indica*) and T₁ (*Pleurotus florida*) with 30.00 g and 28.33 g. T₃ (*Ganoderma lucidum*) had the lowest yield with 9.33 g. At Day 2, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 56.67 g. It is followed by T₄ (*Calocybe indica*) and T₁ (*Pleurotus florida*) with 40.00 g and 38.33 g, respectively while T₃ (*Ganoderma lucidum*) had the lowest yield with 8.68 g.

At Day 3, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 58.33 g. It was followed by T₁ (*Pleurotus florida*) with 48.33 g and followed by T₄ (*Calocybe indica*) with 28.33 g. T₃ (*Ganoderma lucidum*) had the lowest yield with 8.00 g. At Day 4, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 50.00 g. It was followed by T₁ (*Pleurotus florida*) with 45.00 g and followed by T₄ (*Calocybe indica*) with 40.33 g. T₃ (*Ganoderma lucidum*) had the lowest yield with 9.67 g. At Day 5, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 56.67 g. It is followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with 48.33 g and 33.33 g, respectively. T₃ (*Ganoderma lucidum*) attained the lowest yield with 8.33 g.

At Day 6, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 58.33 g. It is followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with 43.33 g and 36.67 g, respectively. T₃ (*Ganoderma lucidum*) attained the lowest yield with 8.67 g. At Day 7, T₂ (*Pleurotus ostreatus*) obtained the highest yield with 51.67 g. It is followed by T₁ (*Pleurotus florida*) with 45.00 g while T₄ (*Calocybe indica*) had 31.67 g. The lowest was T₃ (*Ganoderma lucidum*) with 8.33g.

At Day 8, T₂ (*Pleurotus ostreatus*) and T₁ (*Pleurotus florida*) did not differ from each other with 51.67 g, respectively. While T₃ (*Ganoderma lucidum*) attained the lowest yield with 8.67 g. At Day 9, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 56.67 g. It was followed by T₁ (*Pleurotus florida*) with 48.33 g. followed by T₄ (*Calocybe indica*) with 31.67 g and T₃ (*Ganoderma lucidum*) attained the lowest yield with 9.00 g. At Day 10, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 58.33 g. It is followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with 45.00g and 36.67 g, respectively. T₃ (*Ganoderma lucidum*) had the lowest yield mean with 11.33 g. At Day 11, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 53.33 g. It is followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with 48.33 g and 21.67 g, respectively. While, T₃ (*Ganoderma lucidum*) had the lowest yield mean with 8.00 g.

At Day 12, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 58.33 g. It is followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*) with 43.33 g and 31.67 g, respectively. While, T₃ (*Ganoderma lucidum*) had the lowest yield mean with 12.33 g. At Day 13, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 56.67 g. It is followed by T₁ (*Pleurotus florida*) and T₄ (*Calocybe indica*)

with 51.67 g and 35.00 g, respectively. While, T₃ (*Ganoderma lucidum*) had the lowest yield mean with 7.67 g. At Day 14, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 55.00 g. It is followed by T₄ (*Calocybe indica*) and T₁ (*Pleurotus florida*) with 46.67 g and 40.00 g, respectively. T₃ (*Ganoderma lucidum*) had the lowest yield with 9.33 g. At Day 15, the highest yield was obtained by T₂ (*Pleurotus ostreatus*) with 51.67 g. It was followed by T₁ (*Pleurotus florida*) with 48.33 g, followed by T₄ (*Calocybe indica*) with 40.00 g and T₃ (*Ganoderma lucidum*) attained the lowest yield with 7.67 g.

The variations in stipe length, pileus width and stipe girth of oyster mushroom grown in different farm substrates depend on the type of agricultural waste used in preparing the farm substrates.

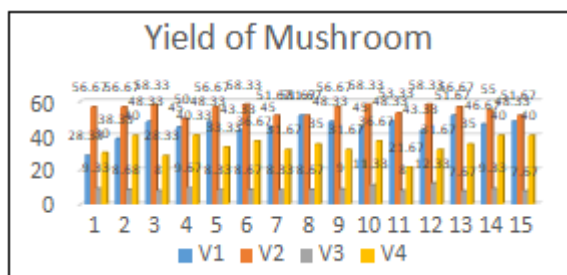


Figure 3: Effect of Sawdust on the Yield (gram/bag) of the Four Varieties of Mushroom for 15 days

4.4 ROI for Mushroom Production per bag

The Return on Investment (ROI) of mushroom production per bag of different varieties is presented in Table 2. It shows the summary of total expenses and Return on Investment (ROI) during the study. *P. florida* obtained the highest percentage with 571.16% followed by *P. ostreatus* with 449.89% while *C. indica* was 314.02%. However, in terms of *G. lucidum* much lower with 9.16% ROI was recorded.

Table 2: Return on Investment (ROI) of Mushroom Production per bag of Four Varieties for 15 days.

Materials	PhP			
	<i>Pleurotus ostreatus</i>	<i>P. florida</i>	<i>Ganoderma lucidum</i>	<i>Calocybe indica</i>
Compost Mixture (sawdust, rice bran and limestone)	250.00	250.00	250.00	250.00
Brown Sugar	20.00	20.00	20.00	20.00
Plastic bag (6x12) cotton	30.00	30.00	30.00	30.00
PVC pipes	100.00	100.00	100.00	100.00
Rubber band	50.00	50.00	50.00	50.00
Paper	25.00	25.00	25.00	25.00
Denatured Alcohol	38.00	38.00	38.00	38.00
Rental	500.00	500.00	500.00	500.00
Total Cost of Production	1,113.00	1,113.00	1,113.00	1,113.00
Total Bag Produced	30	30	30	30
Production Cost per Bag	37.10	37.10	37.10	37.10
Yield/bag cumulative of 15 days (g)	679.98	830.01	135.01	512.01
Gross Income per bag	203.99	249.00	40.50	153.60
Net Income	166.89	211.90	3.40	116.50
Return on Investment (%)	449.84	571.16	9.16	314.02

5. Conclusion

The length of basidiocarp was taken from Day 1 of inoculation to Day 15. Significant results were only recorded at Day 1 while the rest showed non-significant results.

Fluctuating length was recorded measuring basidiocarp and a negative trend was found. It shrinks for 0.02 cm for *P. ostreatus*, 0.04 cm for *P. florida*, 0.003 cm for *G. lucidum* and 0.004 cm for *C. indica*.

There were differences on the diameter of basidiocarp from Day 1 to Day 15 showing *P. ostreatus* as the longest diameter.

Fluctuating trend for width was observed with increase of 0.002 cm for *P. ostreatus*, decreased by 0.02 cm for *P. ostreatus*, decreased by 0.02 for *G. lucidum* and decreased by 0.04 cm for *C. indica*.

Significant yield was also noted among edible mushroom varieties used from Day 1-Day 15. *P. ostreatus* yielded other varieties. Also, fluctuating results were found among treatments.

Highest ROI was recorded from *P. ostreatus* with 571.16% while *G. lucidum* had only 9.16%.

6. Recommendation

Two mushroom varieties show a promising results under 18.9°C to 31°C temperature. These are *P. ostreatus* and *P. florida*. This study further recommends verification using additional mushroom varieties.

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