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Effect of Hole Size and Number on the Fruit-Body Yield of *P. ostreatus* var. *florida* Eger.

Ikechukwuka Cyriacus Okwulehie* • Ikechukwu Adiele Okwujiako

Department of Biological Sciences, Michael Okpara University of Agriculture Umudike, P.M.B. 7267, Umuahia, Abia State, Nigeria

***Corresponding author*: * phylyke@yaoo.com**

ABSTRACT

In this study we wished to determine the effects of plastic pail hole size (sizes 1, 2, 3 and 4 corresponding to 7, 8, 9 and 10 cm, respectively) and number (54, 63, 72 or 81) on the yield and yield characteristics of *P. ostreatus* var. *florida.* Hole size 3 resulted in significantly higher fruit-body number and fresh weight than other hole sizes. Similarly, hole size 3 had fruit-bodies with a significantly wider pileus diameter and stipe length than fruit-bodies produced in hole sizes 1, 2 and 4. The stipe length of the fruit-bodies produced in all hole sizes were not significantly different. Plastic buckets with 72 or 63 holes produced larger and heavier fruit-bodies than 54 and 81 holes. Hole number did not significantly influence the pileus diameter or the stipe length of the mushrooms. Our results are discussed in the context of using appropriate containers for the production of large quantities of sizeable mushroom fruit-bodies.

Keywords: fresh weight, perforation, pileus diameter, stipe length, yield

INTRODUCTION

To cultivate mushrooms, a mushroom culture is established either from the spore or from fruit body tissue. With the tissue culture from a living mushroom body, the cultivator preserves the exact genetic make-up of the contributing mushroom, while, with spores, a single strain must be selected from the multitude of strains created. In both cases the result is a network of hyphae, the mycelium which has to be established; the next step is then to increase the mycelial mass. This is done by first growing the mycelium on enriched agar media in Petri-dishes and then further multiplying it on grain or sawdust (Stamets 1993). The multiplication of the mycelial mass is done by inoculating mycelial mats from the Petri-dishes to grains or sawdust/bran that has been sterilized in jars or bottles in a process known as spawning. When these grain or sawdust-filled jars or bottles have been grown through with the mushroom mycelia, they are called spawn. The spawn can then be used to inoculate suitable substrates in polyethylene bags, perforated buckets, trays in racks, columns, in logs or in moulds (beds), cased with a moisture-laden soil-like layer. After the mycelium has fully colonized the substrate, formation of mushroom fruiting bodies is now encouraged. Encouragement of fruit-body formation in mushrooms centres on altering the prevailing environmental variables in favour of the mushroom reproductive requirements, an act called initiation-strategy. According to Stamets (1993), the initiation strategies for most mushrooms include lowering the temperature for spawn to a temperature plateau ideal for fruiting, applying water to ensure adequate moisture level to raise and sustain optimum humidity, lowering the carbon dioxide load by increasing air exchange, and by introducing and maintaining light suitable for the particular mushroom species. Several types of containers, ranging from perforated polyethylene bags (Fasidi and Ekuere 1993; Sharma 2002), Erlenmeyer flasks (Kang *et al*. 2002) trays, plastic buckets, bottles and wooden racks have been employed to cultivate mushrooms. Fasidi (1996) grew *Volvariella esculenta* on sterilized wastes arranged in flat heaps on a clean terrazzo floor in a cropping room. Perforation of the containers of course, is part of the initiation and fruiting strategy.

The present investigation was conducted to determine the effects of hole number and size on the yield and yield characteristics of *P. ostreatus florida* Eger.

MATERIALS AND METHODS

Effect of hole size

To determine the effects of hole-size on the fruit body yield of the mushroom, five replications of 16 × 17 cm (2000 ml) plastic buckets were used for each of four different hole sizes. Four cork borers of sizes 6, 5, 4, and 3 were used to bore uniform number of holes equivalent to 10, 9, 8 and 7 cm diameter holes on each of the four sets of plastic buckets, respectively. Each of the buckets was filled with 500 g of pre-steeped chopped straw of *Andropogon gayanus*. The buckets of straw were pasteurized at 80°C for two hours in a gas-heated drum. After cooling, the substrate in each bucket was inoculated with 30 g of grain spawn, and placed in wooden racks in the cropping room. The fruit-bodies of the mushroom began to appear after 10 to 12 days after inoculation under optimal climatic condition. The first harvest started after 14-15 days. The mushroom fruit bodies were harvested in flushes for analysis.

Effect of hole number

To evaluate the effects of hole-number on the yield of the mushroom, five replicate of 16× 17 cm plastic buckets were used. A total of 45 holes were bored into each of the 1st set of plastic buckets, 54 holes were bored into each of the 2nd set, 63 holes into each of the 3rd set, and 72 holes into the 4th set. All buckets were each filled with 100 kg of pre-steeped straw of *A. gayanus*, and pasteurized at 80°C in a gas-heated drum for 2 h. After cooling, the straw in each bucket was inoculated with 30 g of grain spawn prepared according to the method previously described by Elhami and Ansari (2008). The buckets were covered and placed in wooden racks in the cropping room. In 10-12 days after inoculation, the mushroom fruit bodies had started maturing. These were harvested in flushes and analyzed.

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Short Communication

Table 1 The effects of plastic bucket hole size on the fruit-body yield of *P. ostreatus* var. *florida.*

Bucket hole size	Mean fruit body yield
1	17.20 ± 7.05 b
2	19.80 ± 7.82 b
3	33.80 ± 6.18 a
4	21.60 ± 12.46 b

Hole sizes: 1 = 7 cm, 2 = 8 cm, 3 = 9 cm and 4 = 10 cm in diameter.
Means ± SD with the same letter(s) are not significantly different (P>0.05, 0.01) by LSD.

Table 2 The effects of plastic bucket hole size on the fruit-body fresh weight of *P. ostreatus* var. *florida.*

Bucket hole size	Mean fruit body fresh weight
1	29.74 ± 9.47 a
2	40.46 ± 15.77 b
3	61.50 ± 14.40 a
4	40.56 ± 18.13 b

Means ± SD with the same letter(s) are not significantly different (P>0.05, 0.01) by LSD.

Table 3 The effects of plastic bucket hole size on the mean pileus size (cm) of fruit bodies of *P. ostreatus* var. *florida.*

Bucket hole size	Mean pileus size
1	3.71 ± 0.12 b
2	3.68 ± 0.58 b
3	4.63 ± 0.50 a
4	3.51 ± 0.65 b

Means ± SD with the same letter(s) are not significantly different (P>0.05, 0.01) by LSD.

Table 4 The effects of plastic bucket hole size on the mean stipe size (cm) of fruit-bodies of *P. ostreatus* var. *florida.*

Bucket hole size	Mean stipe size (cm)
1	1.91 ± 0.33 NS
2	1.60 ± 0.16 NS
3	1.92 ± 0.40 NS
4	1.70 ± 0.17 NS

Means ± SD. NS = not significant according to LSD (P>0.05, 0.01).

Table 5 The effects of plastic bucket hole number on the fruit-body yield of *P. ostreatus* var. *florida.*

Hole number per bucket	Mean fruit body yield
54	7.40 ± 2.70 b
63	18.60 ± 6.77 a
72	24.40 ± 4.51 a
81	11.00 ± 4.06 b

Means ± SD with the same letter(s) are not significantly different (P>0.05, 0.01) by LSD.

Table 6 The effects of plastic bucket hole number on the fresh weight (g) of fruit-bodies of *P. ostreatus* var. *florida.*

Hole number per bucket	Mean fruit body fresh weight (g)
54	24.20 ± 6.67 b
63	46.06 ± 16.66 a
72	56.56 ± 15.62 a
81	29.28 ± 5.73 b

Means ± SD with the same letter(s) are not significantly different (P>0.05, 0.01) by LSD.

Table 7 The effects of plastic bucket hole number on the pileus size (cm) of the fruit-bodies of *P. ostreatus* var. *florida.*

Hole number per bucket	Mean fruit body yield
54	3.50 ± 0.19 NS
63	9.29 ± 13.15 NS
72	4.04 ± 0.49 NS
81	3.58 ± 0.50 NS

Means ± SD. NS = not significant according to LSD (P>0.05, 0.01).

Table 8 The effects of plastic bucket hole number on the stipe size (cm) of the fruit-bodies of *P. ostreatus* var. *florida.*

Hole number per bucket	Mean stipe size (cm)
54	1.79 ± 0.22 a
63	1.66 ± 0.78 b
72	1.80 ± 0.25 a
81	1.48 ± 0.13 b

Means ± SD with the same letter(s) are not significantly different (P>0.05, 0.01) by LSD.

RESULTS AND DISCUSSION

Effects of plastic bucket hole size on the fruit-body yield and fresh weight

Hole size 3 resulted in significantly higher fruit-body number and fresh weight (i.e. yield) than hole sizes 1, 2 and 4 (**Tables 1, 2**). The hole size 3 gave higher yield than the rest of the hole sizes used in the investigation. Previous work on this aspect was not available for comparison.

Hole size, pileus diameter and stipe length

Hole size 3 produced fruit-bodies with an average pileus diameter significantly wider than those of the fruit-bodies produced in hole sizes 1, 2 and 4 (**Tables 3, 4**), although the stipe length of the fruit-bodies produced in all the hole sizes was not significantly different (P>0.05). The pileus is the preferred part of most mushrooms (Demier *et al*. 2005), therefore mushrooms with a broader pileus and short stipes are desirable, as produced in vessels with hole size 3.

Hole number, fruit-body yield and fresh weight

Fruit-bodies with a significantly greater average fresh weight were obtained in buckets with 63 or 72 holes as compared to buckets with 54 or 81 holes (**Tables 5, 6**).

Hole number, pileus diameter and stipe length

Fruit-bodies with an average pileus diameter were wider in buckets with 63 holes than in those with 54 or 81 holes (**Table 7**). Similarly, bucket hole number influenced stipe length of the fruit-bodies very little (**Table 8**).

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