PERFORMANCE OF MUSHROOM FRUITING FOR LARGE SCALE COMMERCIAL PRODUCTION

PRESTASI PEMBUAHAN CENDAWAN
BAGI PENGELUARAN KOMERSIL BERSKALA BESAR

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Abstract

The paper described the determination of mushroom fruiting yield, which is vital to economics of mushroom production. Consistency in mushroom yields enabling an estimation to be made for revenues and hence profitability could be predicted. It has been reported by many growers, there are a large variation in mushroom yields over different times of production. To assess such claims we have run four batches of mushroom fruiting and the performance fruiting body productions are presented.

Abstrak

Kertas kerja ini menjelaskan mengenai penentuan hasil pembuahan cendawan sangat penting bagi ekonomi pengeluaran. Hasil cendawan yang konsisten membolehkan telahan dibuat bagi pendapatan penanam dan membolehkan kiraan keuntungan dijangkakan. Telah dilaporkan oleh penanam cendawan terdapat perbezaan besar hasil dalam tempoh pengeluaran. Untuk menilai kenyataan tersebut kami telah membuat penilaian terhadap empat "batch" pengeluran dan prestasi pengeluaran dibentangkan.

Keywords/Kata kunci: mushroom fruiting yield

INTRODUCTION

Mushroom cultivation is biotechnology related industry. The typical biotechnology industry such as mushroom cultivation has been pretty much low end biotechnology which survived dependent on skill in tissue culture technology by the growers. Less skilful growers faced many problems such as high percentage of contamination on their cultivated substrate, unavailability of high quality mushroom seed and large variation in mushroom yields (Department of Agriculture Malaysia, 2008).

The key factor to success in this industry required higher skill than tissue culture technology, the grower need to be a better knowledge in mushroom biotechnology. We witnessed the failure of many mushroom growers mainly due to the lack of knowledge in mushroom biotechnology, especially in production of mushroom seeds. Many companies dependent on their seed supply for cultivation of mushroom from unreliable sources because of unavailability of seed supplier in the country. In order to support the development of biotechnology industries in general, including mushroom industries, the Government had launched the National Biotechnology Policy which outlined the strategies for biotechnology companies to reach to the global competitive advantage. The implementation of the National Biotechnology Policy encompasses three phases that includes: Phase 1 (2005-2010) for Capacity Building; Phase 11 (2011-2015) initiative for Lab to Market; Phase 111 (2016-2020) reached Global Business with competitive leading edge biotechnology industry (National Biotechnology Policy, 2006). The proposed National Biotechnology Policy implementation has been further enhanced with Bioeconomy Initiative Malaysia (BIM) launched in November, 2010. Bioeconomy, which encompasses the application of biotechnology to primary industries is one of the National Key Economic Areas (NKEA) for Malaysia (http://www.biotechcorp.com.my/media/biomalaysia-plans-for-a-bioeconomy, 2010). In addition, mushroom has been listed as a new commodity in by Government to support the balance of trade (BOT) for international trading of agriculture products (Department of Agriculture, 2008). Recently, the Malaysian Government has identified mushroom as one of subject for Entry Point Project (EPP) in the National Key Economic Area (NKEA)'s for agriculture (Economic Transformation Programme, A Roadmap For Malaysia, 2010).

In order to achieve a competitive edge companies in mushroom industry, they must be able to address the problem statement described above. Severral years ago, production of *Pleurotus* spp., mostly based on cereal straw, was the second after *Agaricus bisporus*, with a share of 24.2% of world production (Aksu *et al*., 1996). Today, the production of *Pleurotus* spp had surpassed other types of mushrooms (Chang, 2008). This paper described the performance of oyster mushroom, *Pleurotus sajor caju* production, grown on rubberwood sawdust grown on rubberwood sawdust as case study to assess the production capacity and efficiency for commercial production.

MATERIALS AND METHOD

About 2,000 ready fruiting oyster mushroom logs were produced at Bioprocess Group, Malaysian Nuclear Agency by a commercial production company using a minimal nutrient supplement mushroom cultivation substrates. The mushroom logs were placed on four fruiting racks with each rack contains 480 logs of fruiting ready mushroom logs. All mushroom logs were open for fruiting simultaneously within a period of one week for each fruiting cycle. After each cycle of fruiting the mushroom logs were closed to allow further re-growing of mushroom mycelia in the mushroom production logs, after which the mushroom logs had been exhausted after the first cycle of mushroom production. The new mycelia growth that later reached at an appropriate mycelia density would have initiated the next cycle of mushroom fruiting. These processes of re-growing mycelia within the mushroom logs for mushroom production had been repeated several times until the mushroom logs had no longer produced any mushroom. The interval between harvests was fixed for two weeks.

The data was collected over the period of seven (7) months from 11August 2011 through 12 March 2012. The fruiting performance of mushroom were analysed using Analysis of Variance (ANOVA) of Statistical Software SPSS and Significant means were compared by the Duncan's Multiple Range Test (DMRT) at $P < 0.05$.

The Biological Efficiency was calculated based on the percentage ratio of fresh mushroom yield of the dry matter of mushroom substrate (Chang, 1982).

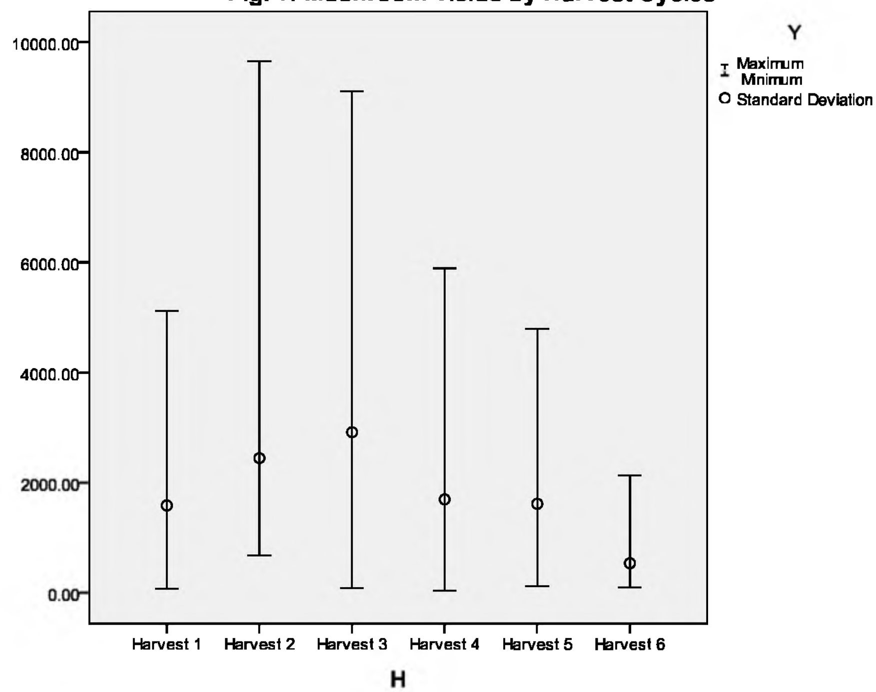
RESULTS AND DISCUSSION

The performance of mushroom fruiting was measured based on the mushroom yield produced: it described yield variation with harvest cycles and its distribution on incubation racks.

1. **Performance of fruiting based on harvesting cycle.**

   Mushroom harvesting activities required 85 days for a total of six (6) harvesting cycles. Harvest cycle 1 required 26 days which implied that mushroom were available for harvesting daily over this period. The average harvests were 1,542.1 g, with large variation in harvest yields, up to 1,587.1 g as indicated by standard deviation from statistical data of this harvest analysis. The yield harvested can vary from 900 g to 2183.6 g. The highest harvest average was recorded in the harvest cycle 2. For subsequent harvests only 10 to 12 days were need for each harvesting cycle. Obviously there was a significant difference between yields obtained from harvest cycle (P=0.016<0.05). The overall performance of mushroom fruiting is shown in Figure 1.

Fig. 1: Mushroom Yields by Harvest Cycles



2. **Performance of mushroom fruiting on different incubation racks.**

The frequency of fruiting recorded on incubation racks 1, 2, 3 and 4 were 22, 22, 17 and 24 times respectively. The number of times of mushroom fruiting also reflected the numbers of days fruiting has taken place as described in part 1 above. The highest mean yield was 2,157.1 g, recorded on Rack 2 and the corresponding maximum yield recorded was 9,099.5 g. The general performance of yield harvested showed, all mushroom yields harvested had variation in the mean or average yield on different incubation racks. They varied from 1,264.0 g (minimum yield in Rack 4) to 2,157.1 g (maximum yield in Rack 2) and also variation in the yield as reflected in standard deviation variation from 1,309.7g to 2,413.3 g. However, the overall fruiting performance on different racks showed no significant difference (P=0.489>0.05) as shown in

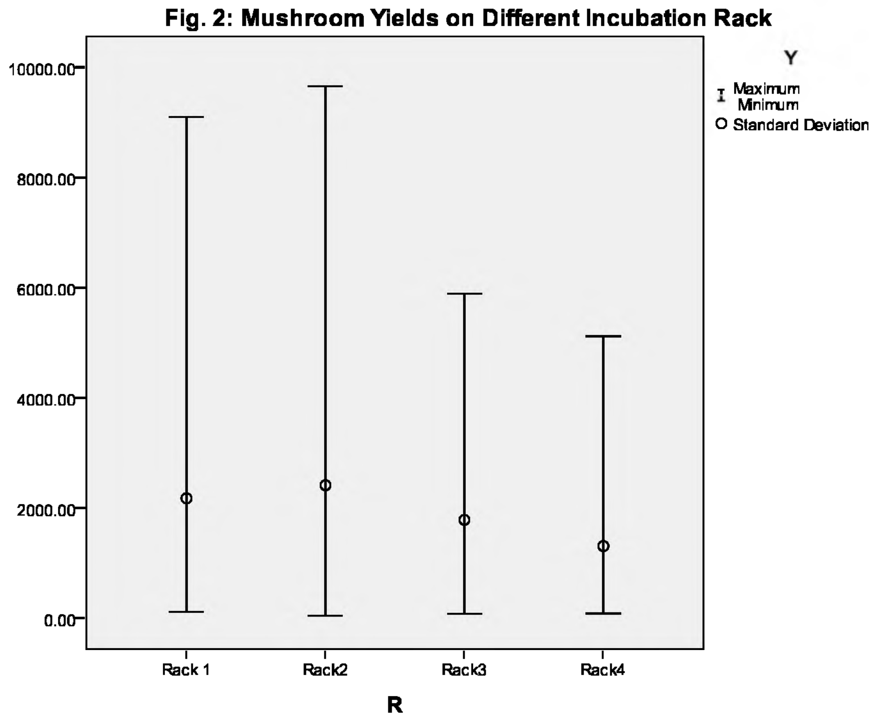


Figure 2.

3. Overall Mushroom Fruiting Performance

The overall trend of mushroom fruiting performance when taking into account both factors of different incubation racks and the different harvest cycles is represented in Figure 3. Each box represented a single harvest cycle for each incubation rack. For example in the harvest cycle 1 (Harvest 1) and incubation rack number 1 (Rack 1), there were five lines designated to the values of mushroom yield obtained in this harvest cycle. The lines correspond to the appropriate values of mushroom yields of 426.1 g (Day 4), 538 g (Day 5), 961.6 g (Day 2), 1648.1 g (Day 3), and 4560 g (Day 1) respectively, given at the bottom of the Figure 1.

The mushroom yield distribution as according to the harvest cycle showed the first harvest cycle was most productive and they decreased in the subsequent harvests. In the first harvest, it produced a total of 40,096.9 g of mushrooms from mushroom logs in all racks; the yield accounted for 27.5 % of the total mushroom production in this experiment. In the subsequent harvest cycle, the yield of mushroom production calculated based on the first yield, showed a decreased in yield to 10% and it went 33 % further down compared to the first yield, in the third cycle. In the fourth and fifth cycle, it decreased further down to a half (50%) of the first yield recorded. In the last cycle only 4 % mushroom was obtained. The overall production of mushroom was 145,663.1 g, over the period of 30 days of active production. In our estimate for the daily production of mushroom, we have taken into account the total mushroom produced from each harvest cycle and the numbers of production days per harvest cycle, which was five (5) days and excluding the interval time between harvests. Having considered those production conditions, the average mushroom production obtained was 4,855.4 g/day.

The Biological Efficiency of mushroom was 21 %, It was extremely low from our previous results. The fruiting yields per log were recorded low, from 35 – 40 g per log, a half of the yield that we normally obtained. We have obtained higher yield that was closed to 100 % and the fruiting yield per log was 80-100 g (Mat Rasol *et. al.*, 1998; Rosnani *et. al*, 2006). There were rooms for yield improvements such as improvement on the enrichment of mushroom cultivation substrates and provision of a proper substrate conditioning before cultivation.

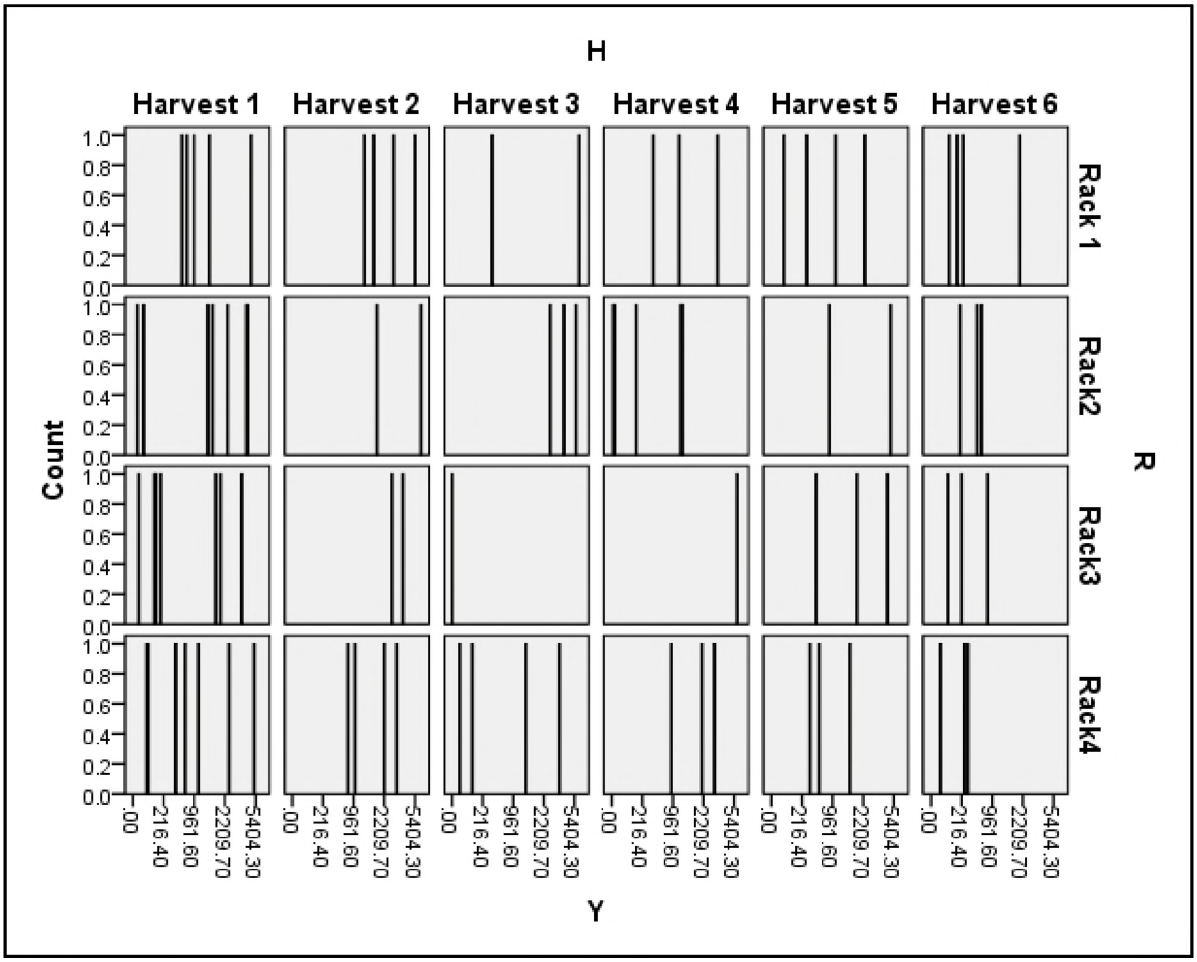


Figure 1: Performance of mushroom fruiting from different harvest on all incubation racks

CONCLUSION

The performance of oyster mushroom, *Pleurotus sajor caju* production, grown on rubberwood sawdust in this study was low. This is mainly due to two factors, first of all the cultivation substrates were supplemented with low nutrient that resulted in nutrient exhaustion from cultivation substrate after the third cycle of harvests, this was displayed by the yield of mushroom dropped more than 50 % of the first harvested yield. The second factor was on the substrate conditioning had not been done properly which consequently resulted in poor mycelia growth. Mushroom with such fruiting performance could not be used for commercial production. For commercial production, the average fresh mushroom yield per log must be around 80-100g and it should be able to be harvested at least four cycles with Biological Efficiency of 87.7 – 110 % (Mat Rasol *et al,* 2009).

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