Evaluation of different casing materials for growth and yield of button Mushrooms (*Agaricus bisporus* (L.) Sing.)

Anurag Kerketta, CS Shukla and HK Singh

Abstract

Six different casing materials (alone and combination) were evaluated for growth and yield of button mushroom. Casing materials viz., cocopeat, vermicompost + cocopeat (1:1), vermicompost + soil (1:1), cocopeat + soil (1:1) vermicompost + cocopeat + soil (1:1:1) and soil + FYM + sand (1:1:1) were used as casing materials and analysed for pH, EC (Electrical conductivity) and WHC (Water holding capacity). The results revealed that the pinhead initiation was significantly fastest in cocopeat + soil and it was delayed in soil + FYM + sand. Yield attributing characters like stalk length, stalk diameter and pileus diameter did not differ significantly with respect to casing materials and it varied form 2.63-3.45cm, 1.58-1.76cm and 3.99-4.50cm respectively. Number of fruiting bodies and yield were also found insignificant and ranges from 8.66-19 and maximum yield (355g) was obtained in cocopeat + soil with highest biological efficiency 11.83%. pH, EC and WHC found in ranges from 5.4-7.5, 0.55-1.98 ds/m and 59.44-271.10% respectively. When it correlated with yield, the maximum yield was obtained in casing material (cocopeat + soil) which has 5.6 pH, EC 1.98 ds/m and WHC 238.97% whereas, the minimum yield was found in the casing material (soil + FYM + sand) which has pH 7.5, EC 0.55 ds/m and WHC 59.44%.

Keywords: Casing, cocopeat, vermicompost, EC and WHC

Introduction

Cultivation of button mushroom is being undertaken by the farmers on large scale, especially in cooler hilly regions. One crop can easily take during the winter season in the plains and foothills of North India and other parts of country where temperature goes below 20 ºC accompanied with high relative humidity. Crop residues such as grain crop straw are characterized by the predominance of lignocelluloses with cellulose, hemicellulose and lignin as the main components (Yildiz et al., 2002; Das and Mukherjee, 2007; Mamiro and Mamiro, 2011; Jonathan et al., 2012) [1-4]. Using such crop residue as a mushroom substrate would subsequently convert them into a more protein-rich biomass and influence the mushroom yields (Mamiro and Mamiro, 2011) [3]. The high potential of such substrates for growing mushroom could be economically attractive and profitable for farmers and agriculture more widely. Besides, it is converting farm waste into useful products which could later help maintain the nutrient requirement of crops, soil physical and chemical condition, and also balance the ecological demands on the crop production system (Naresh, 2013) [5].

*Agaricus bisporus* requires two different substrates to form the fruiting bodies i.e. the compost for nutrition on which it grows vegetatively and the casing soil in which the suitable physicochemical/biological conditions stimulate the initiation process of pin head formation for fruit body production. In spite of being nutritionally deficient medium, casing layer plays an important role in the production of button mushroom. The casing layer is one of the important growing parameter and source of variation in production, quality and uniformity of commercial cropping (Kaur and Rampal, 2017) [6]. Huge quantities of farm yard manure, vermicompost, saw dust and other organic wastes are generated annually through the activities of agricultural, forest and food processing industries. Mushroom yield can be increased if these locally available casing mixtures are used to produce button mushrooms (Chandra et al., 2014) [7]. Therefore, present investigation was carried out to see the effect of different casing mixtures on the growth parameters and yield potential of button mushroom in Chhattisgarh.

Materials and Methods

Pure culture and other materials

Pure culture of button mushroom was procured from AICRP on mushroom, Department of Plant Pathology, CoA, IGKV, Raipur, Chhattisgarh. And
for experiment were obtained from mushroom Research Laboratory of the Department of Plant Pathology.

**Composting and spawning**

Wheat straw based compost was prepared using long method of composting (Khanna and Kapoor, 2007) [8]. For compost preparation, wheat straw 5000 kg, Rice bran 12 kg, Urea 9 kg and Gypsum 18 kg were used. The spawning was done by layer method in polypropylene bags (16"x22") filled 05 kg compost in each bag and spawned @ 50 g bag⁻¹ by layer method and shifted to the growing room for spawn run.

**Preparation of casing materials**

Five different base materials viz., vermicompost, cocopeat, soil, FYM and sand were selected for preparation of casing mixtures which were obtained from Agro farm of IGKV and commercial outlet of Raipur. Base materials were used alone and in combination (equal amount of each base material) for casing the completely colonized mushroom bag. Before use, casing mixtures were sterilized using 5 % formaldehyde/litre water. Observations were recorded for their effect on growth behaviour of button mushroom.

**Analysis of casing materials**

The casing materials prepared six different casing materials were analysed for pH, EC (Electrical conductivity) and WHC (water holding capacity) and data are depicted in Table No 1. The Cocopeat had lowest pH value (5.4) followed by combination of cocopeat + soil (5.6), vermicompost + cocopeat + soil (6.5), vermicompost + cocopeat (6.7) and vermicompost + soil (7.2). While maximum pH value (7.5) was recorded in mixture of soil + FYM + sand. Water holding capacity of casing materials was found maximum (271.10%) in cocopeat whereas the minimum (59.44%) water holding capacity had combination of soil + FYM + sand. Water holding capacity of casing materials was found maximum (271.10%) in cocopeat whereas the minimum (59.44%) water holding capacity had combination of soil + FYM + sand following by combination of vermicompost + cocopeat (69.39%), vermicompost + soil (108.50%), vermicompost + cocopeat + soil (163.92%) and cocopeat + soil (238.97%).

**Results and Discussion**

**Analysis of casing mixtures**

Prepared six different casing materials were analysed for pH, EC (Electrical conductivity) and WHC (water holding capacity) and data are depicted in Table No 1. The Cocopeat had lowest pH value (5.4) followed by combination of cocopeat + soil (5.6), vermicompost + cocopeat + soil (6.5), vermicompost + cocopeat (6.7) and vermicompost + soil (7.2). While maximum pH value (7.5) was recorded in mixture of soil + FYM + sand. Water holding capacity of casing materials was found maximum (271.10%) in cocopeat whereas the minimum (59.44%) water holding capacity had combination of soil + FYM + sand followed by combination of vermicompost + cocopeat (69.39%), vermicompost + soil (108.50%), vermicompost + cocopeat + soil (163.92%) and cocopeat + soil (238.97%).

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**Table 1: Analysis of Casing materials for pH, EC and WHC.**

<table>
<thead>
<tr>
<th>Casing materials</th>
<th>pH</th>
<th>EC (dS m⁻¹)</th>
<th>WHC (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocopeat</td>
<td>5.4</td>
<td>1.45</td>
<td>271.10</td>
</tr>
<tr>
<td>Vermicompost + Cocopeat (1:1)</td>
<td>6.7</td>
<td>1.97</td>
<td>69.39</td>
</tr>
<tr>
<td>Vermicompost + Soil (1:1)</td>
<td>7.2</td>
<td>1.35</td>
<td>108.50</td>
</tr>
<tr>
<td>Cocopeat + Soil (1:1)</td>
<td>5.6</td>
<td>1.98</td>
<td>238.97</td>
</tr>
<tr>
<td>Vermicompost + Cocopeat + Soil (1:1)</td>
<td>6.5</td>
<td>1.02</td>
<td>163.92</td>
</tr>
<tr>
<td>Soil + FYM + Sand (1:1)</td>
<td>7.5</td>
<td>0.55</td>
<td>59.44</td>
</tr>
</tbody>
</table>

**Table 2: Evaluation of casing materials for yield of button mushroom**

<table>
<thead>
<tr>
<th>Casing materials</th>
<th>Pinhead initiation*</th>
<th>Stalk length*</th>
<th>Stalk diameter*</th>
<th>Pileus diameter*</th>
<th>No of fruiting bodies**</th>
<th>Yield (gm)**</th>
<th>BE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocopeat</td>
<td>13.62</td>
<td>2.95</td>
<td>1.71</td>
<td>4.37</td>
<td>14.66</td>
<td>263.33</td>
<td>8.77</td>
</tr>
<tr>
<td>Vermicompost + Cocopeat (1:1)</td>
<td>12.87</td>
<td>2.63</td>
<td>1.69</td>
<td>4.30</td>
<td>9.66</td>
<td>198.33</td>
<td>6.61</td>
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<tr>
<td>Vermicompost + Soil (1:1)</td>
<td>14.12</td>
<td>2.76</td>
<td>1.73</td>
<td>4.18</td>
<td>10.33</td>
<td>216.66</td>
<td>7.22</td>
</tr>
<tr>
<td>Cocopeat + Soil (1:1)</td>
<td>12.25</td>
<td>3.10</td>
<td>1.71</td>
<td>4.24</td>
<td>19.00</td>
<td>355.00</td>
<td>11.83</td>
</tr>
<tr>
<td>Vermicompost + Cocopeat + Soil (1:1)</td>
<td>13.37</td>
<td>3.05</td>
<td>1.70</td>
<td>4.50</td>
<td>13.00</td>
<td>288.33</td>
<td>9.61</td>
</tr>
<tr>
<td>Soil + FYM + Sand (1:1)</td>
<td>15.62</td>
<td>3.45</td>
<td>1.58</td>
<td>3.99</td>
<td>8.66</td>
<td>191.66</td>
<td>6.38</td>
</tr>
<tr>
<td>SEma</td>
<td>0.32</td>
<td>0.17</td>
<td>0.05</td>
<td>0.19</td>
<td>2.52</td>
<td>36.67</td>
<td></td>
</tr>
<tr>
<td>CD (5%)</td>
<td>0.92</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** (*) Average of ten replications/fruiting bodies. (**) Average of three replications. (-): Non significant.
Effect of casing mixtures on growth and yield of button mushroom
Six different casing materials were evaluated to see the effect on growth and yield of button mushroom and data are presented in table No. 2.
Pinhead initiation differed significantly with respect to different casing materials and yield attributing characters like stalk length, stalk diameter, pileus diameter, number of fruiting bodies and yield also found insignificant. Pinhead initiation was fastest (12.25 days) in bag which had cocopeat + soil (1:1) as casing material followed by vermicompost + cocopeat (1:1) (12.87 days), vermicompost + cocopeat + soil (1:1:1) (13.37 days), cocopeat (13.62 days) and vermicompost + soil (1:1) (14.12 days) whereas it was delayed (15.62 days) in soil + FYM + sand (1:1:1). Stalk length, stalk diameter, pileus diameter and number of fruiting bodies varied from 2.63 – 3.45 cm, 1.58 – 1.73 cm, 3.99 – 4.50 cm and 8.66 – 19.00 respectively. The maximum (355.00 gm) fresh yield obtained from bag which had cocopeat + soil (1:1) with highest (11.83%) biological efficiency while minimum (6.38%) biological efficiency. This result is close with finding of Dhar et al. (2006) [13] that reported eight commonly available casing materials in India viz., Farm Yard Manure (FYM), Spent Mushroom Compost (SMC), Coir pith, Municipal Garbage, Vermicompost, Terracare-A, Terracare-B and farmyard manure (FYM) + SMC in button mushroom cultivation.

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References