The Pharma Innovation Journal 2021; 10(9): 604-607

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(9): 604-607

www.thepharmajournal.com
Received: 10-07-2021
Accepted: 12-08-2021

Anil Kumar Sharma
Department of Plant Pathology, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

Dr. SS Sharma
Department of Plant Pathology, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

Ashok Kumar Gurjar
Department of Plant Pathology, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

Corresponding Author:
Anil Kumar Sharma
Department of Plant Pathology, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

Effect of different casing materials on growth and yield of *Calocybe indica*

Anil Kumar Sharma, Dr. SS Sharma and Ashok Kumar Gurjar

Abstract
The present study was carried out with an aim to find out suitable casing material for commercial cultivation of *Calocybe* indica. Casing is a key phase in Milky mushroom production. It promotes the formation of pinheads from vegetative mycelium, which leads to mature basidiocarps. Therefore, an experiment was planned at Maharana Pratap University of Agriculture and Technology, udaipur Rajasthan. in which Farm yard manure (FYM), biogas spent slurry, and spent compost were used in four different combinations to evaluate their impact on *Calocybe indica* yield. Casing mixture were analyzed for the Bulk density, Particle density, Porosity and Water holding capacity. The porosity of casing mixtures ranged between 50-55% with maximum in spent compost + biogas spent slurry (1:1 v/v) as a result of maximum percent pore space, highest water holding capacity i.e. 135% recorded in spent compost + biogas spent slurry. Out of four casing mixtures were tested a mixture of Spent compost + biogas spent slurry (1:1 v/v) gave maximum biological efficiency of 109.58% with highest number of fruiting bodies i.e. 30.2.

Keywords: *Calocybe indica*, casing, biogas spent slurry, spent compost, farm yard manure, yield

Introduction
Mushrooms are now a days considered to be highly preferable delicious commodity as these are highly nutritious which carry numerous medicinal benefits by virtue of their contents and it is environment friendly too. The cultivation of edible Mushrooms carry great importance in today's world in the context of a increasing population and extreme pressure on the environment. Mushroom cultivation is a latent biotechnological practice wherein, the agro waste or agro-residues can be transformed into protein rich valuable food. Mushrooms have been famous also due to high medicinal properties such as anti-ageing, antiviral, having ample antioxidants, anti-hypertensive, antimicrobial, antibacterial, anticancer, anti-tumor, anti-inflammatory and anti-hypertensive (Patel *et al.* 2012) [7]. They have immuno-moderating properties that has relevance in present day Covid-19 like circumstances. Popularly cultivated mushroom in the world is shiitake, followed by *Pleurotus*spp. estimated world mushroom production in 2018-19 was 43 million metric tonnes with shiitake contributing 26%, Auricularia spp 21%, *Pleurotus oeseratus* 16%, button 11%, Flammulina 7%, King oyster 5%, paddy straw mushroom 1% and Milky/ others 13% (Singh 2021) [11]. Production of Milky mushroom involves a number of operations. Once the spawn run is complete, the crop enters into reproductive phase leading to production of fruiting bodies. Even if the colonization of substrate has happen, fructi fication will not take place until the colonized substrate is covered with casing layer. In large scale cultivation of Milky mushroom, casing is an important agronomic practice on which fruit bodies appear. The casing layer is used to cover the compost after the germination phase and rouse the transition from vegetative to reproductive growth (Pardo *et al.* 2004) [6]. Casing provide moisture and allow gases to escape from the substrate and also provide the mechanical support. Sterilized Casing material is spread in uniform layer of 2-3 cm thickness and saturation level (Doshi *et al.* 1993) [1]. Casing is the most important factor influencing yield after spawn and substrate. Casing of mushroom bag refers to the process of applying a layer of soil-compost mixture to the open surface of a fully spawned run bag. This layer not only provides water for growth and development, but it also provides physical support for fruiting bodies' development.

The quality of the casing layer is determined by the composition of the casing mixture, such as texture, compactness, pH, structure, water holding capacity, porosity, and bulk density. which affects the mycelial growth in the casing layer and the initiation of fruiting bodies. FYM, Spent compost, and biogas spent slurry are some of the preferred casing materials were include.

Hence current study was carried out in order to select a suitable casing material for commercial cultivation of *Calocybe indica*.

Materials and Methods

Filling and spawning

Polythene bags 14 x 20 inches in size were filled with 3 kg substrate and spawned at a rate of 150g/kg dry substrate. The spawning occurred on 6-08-2020, and total days of spawn run were 12-19 days. The surface was levelled, the bags were sealed, and the bags were kept in the growing room until mycelial impregnation was complete.

Preparation and treatment of casing mixtures

Wheat straw was used as a substrate during the study. FYM, biogas spent slurry and spent compost, four casing mixture were prepared by using these three components. FYM, FYM + biogas spent slurry (1:1 v/v), FYM + Spent compost + biogas spent slurry (1:1:1 v/v) and Spent compost + biogas spent slurry (1:1 v/v). All four casing mixtures were sterilized by using 0.2% formaldehyde solution and kept for 48 hours in closed container and then opened to remove the fumes. After sterilization of casing mixture, it was applied on 28-08-2020 the open surface of a fully spawned run bags at uniform thickness of 1.5 inch was maintained throughout the combination. During the investigation, the following parameters were investigated spawn run, days required for pinhead formation, average number of sporophores and biological efficiency The biological efficiency was calculated by the following formula of Chang 1981.

B.E. % = (Fresh fruiting bodies (g))/(Dry weight of substrate(g)) X 100

Characterization of casing material

Physical and chemical parameters of the casing soil mixtures were determined. Water holding capacity, porosity, bulk density, and particle density of casing soil sample were determined during physical characterization. The pH and electrical conductivity were chemically characterised. On the elico pH metre, the pH of the sample was determined using the potentiometric method (Sekhon *et al.*, 1986) [10]. The sample's electrical conductivity was measuredusing a solu-bridge conductivity metre (Sekhon *et al.*, 1986) [10].
The bulk density was calculated by the following formula.

Bulk density = W1-W2 / V g/cm3

Where,
W1 = Weight of empty bottle
W2 = Weight of bottle and soil
V= Volume of the soil
Particle density was calculated using following formula.
Particle density =

$$\text{Particle density} = \frac{10}{W2+10-W3}$$

Where –
10 = weight of casing material taken.
$W_2 + 10 - W_3$ = Weight of water displaced by soil.
Porosity was calculated by using the following formula.

$$\text{Per cent pore space} = 1 - \frac{\text{Bulk density}}{\text{Particle density}} \text{ X } 100$$

Water holding capacity was calculated by the following formula

$$\text{WHC} = \frac{W3-W2-W4}{W2-W1}$$

Where
W_1 = Weight of the box + filter paper
W_2 = Weight of the box + dry soil
W_2-W_1= Weight of the dry soil
W_3 = Wight of the box + soil after moistering it
W_3-W_2 = Weight of the moisture absorbed
W_4 = Moisture absorbed by the filter paper
W_3-W_2-W_4 = Moisture retained by the soil alone

Statistical analysis: Various data were statistically analysed by using OPSTAT software developed by department of mathematics statistics, CCS HAU, Hisar.

Result and Discussion

Physical, chemical and yield parameter of different casing mixtures

In the present investigation, four casing combination i.e. FYM, FYM + biogas spent slurry (1:1 v/v), FYM + spent compost + biogas spent slurry (1:1:1 v/v), Spent compost + biogas spent slurry (1:1 v/v) were analysed to study their physical properties namely water holding capacity, porosity, Bulk density, particle density, pH and electrical conductivity. As these parameters have been reported to have direct relation with production. Peyvast *et al.* (2011) [8] reported that the required physical and chemical properties of a good casing should be high porosity and water holding capacity, 7.2-8.2 pH and free of disease and pests. Our Analysis showed that spent compost + biogas spent slurry (1:1 v/v) had the highest water holding capacity (135%) followed by FYM + Spent compost + biogas spent slurry (120%) and FYM + biogas spent slurry (90%). Similarly, maximum pore space was found in Spent compost + biogas spent slurry (55.05%) followed by FYM +Spent compost + biogas spent slurry (52.08%). It is an established fact that bulk density of casing material affects porosity which proportionally affects the water holding capacity of casing soil. All these factors together determine the quality of casing soil. Bulk density and particle density resulted into different trend than the porosity and water holding capacity, higher the bulk density lower is the porosity. FYM had highest Bulk density (0.74 g/cm3) and particle density (1.5g/cm3); whereas, spent compost + biogas spent slurry had the lowest bulk (0.40 g/cm3) and particle density (0.89 g/cm3). The acidity and alkalinity also affects the production. In the present study pH of the casing materials ranged between 7.6 to 7.9, the highest being recorded in FYM and lowest in Spent compost + biogas spent slurry. In this study electrical conductivity of casing mixture ranged between 1.2 to 1.6, highest electrical conductivity was recorded in FYM and lowest in FYM + biogas spent slurry + spent compost. The variation in different physical properties of various casing materials have also been studied by other workers (Rainey *et al.* and Singh *et al.* 2000) [9]. Spent compost + biogas spent slurry having lowest electrical conductivity was recorded as best casing material. Gier (2000) [3] suggested that addition of salts led to increase in the EC value of the casingsoil making it more difficult for mushroom to extract water from the soil.

Table 1: Physical (Water holding capacity, Porosity, Bulk density and Particle density), Chemical (pH and Electrical conductivity) characterization of casing mixtures.

Treatments	Water holding capacity (%)	Porosity (%)	Bulk density (g/cm^3)	Particle density (g/cm^3)	pH	Electrical conductivity (dS/m)
FYM	60	50.66	0.74	1.5	7.9	1.6
FYM + biogas spent slurry	90	51.85	0.65	1.35	7.8	1.4
FYM + Spent compost + biogas spent slurry	120	52.08	0.46	0.96	7.6	1.2
Spent compost + biogas spent slurry	135	55.05	0.40	0.89	7.5	1.3

Effect of different casing materials on productivity of *Calocybe indica*

All the casing materials were evaluated for their effect on yield, as per figure 1. Early emergence of pinheads occurred on FYM + spent compost + biogas spent slurry (22.4 days) followed by FYM (24.11). Delayed pin head formation was recorded in FYM + biogas spent slurry. As per figure 2. Maximum yield of 1095.8 g per 1 kg wheat straw was harvested from the bag cased with Spent compost + biogas spent slurry (1:1) with maximum number of fruiting bodies *i.e.* 30.2 per 1 kg wheat straw followed by FYM + biogas spent slurry (1:1) i.e. 982.4 g with 29.5 fruiting bodies per 1 kg wheat straw (Table 2). Lowest yield of 760.3 g per 1 kg wheat straw was harvested from the bag cased with FYM with minimum number of fruiting bodies (25.7). better result with Spent compost + biogas spent slurry (1:1 v/v) could be attributed to its property of having low salt concentration as higher salt concentration of casing medium results in yield reduction (Flegg, 1960; Hayes *et al.* 1981 [4] and Kurtzman, 1995) [2]. The lowest yield with FYM could be attributed to its high salinity that resulted in to yield reduction as reported in case of *A. bisporus* (Flegg, 1960; Levanon *et al.* 1986 and Kurtzman, 1995 [2].

Table 2: Effect of different casing materials on productivity of *Calocybe indica*

Treatment	Days taken to pin head initiation	Number of fruiting bodies	Yield (g)	Biological efficiency %
FYM	24.1	25.7	760.5	76.05
FYM + biogas spent slurry	27.5	29.5	982.4	98.24
FYM + Spent compost + biogas spent slurry	22.4	28.6	866.9	86.69
Spent compost + biogas spent slurry	25.2	30.2	1095.8	109.58
SEm±	0.4	0.5	48.8	4.8
CD(p=0.05)	1.3	1.5	146.2	14.6

All the observations are average of five replications.

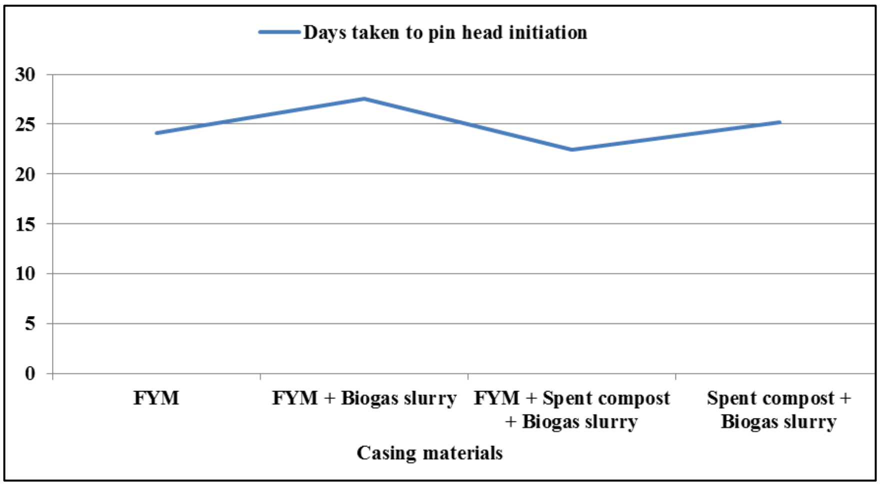

Fig 1: Average number of days taken for pin head initiation on different casing materials.

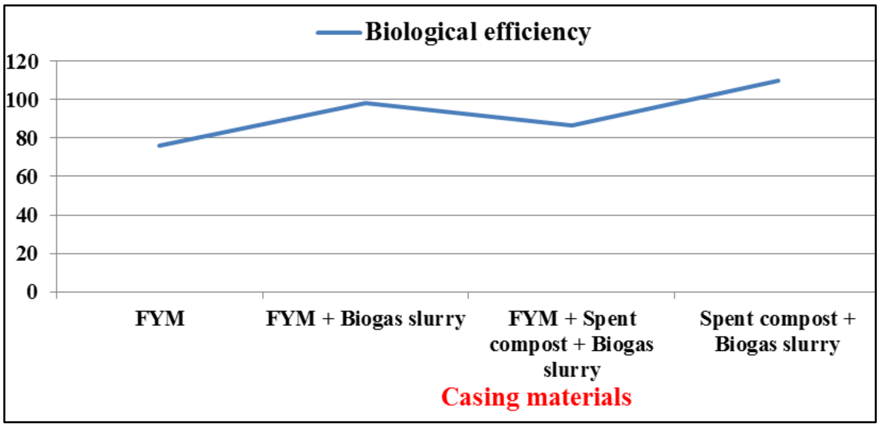

Fig 2: Biological efficiency obtained from different casing materials

Plate 1: Effects of different Casing materials on *Calocybe indica* production

References

1. Doshi A, Sharma SS, Trivedi A. A promising edible mushroom for the tropics *Calocybe indica* P&C. Mushroom Info 1993;86:14-22.
2. Flegg PB. Cropping without casing layer. MGA bulletin 1960;124:123-124
3. Gier JF. de. A different perspective on casing soil. In: Science and Cultivation of Edible Fungi (Van Griensven. ed.) Balkema Rotterdam 2000, 931-34.
4. Hayes WA. Inter-related studies and physical, chemical and microbiological factors in casing soils and relationship with productivity in commercial culture of *A. bisporus* (Lange) Pilat. Mushroom science 1981;11:103-129.
5. Kurtzman RH. Cobalt chloride and ethylene effect on fruiting of Agaricus bisporus. Mycologia 1995;87:366-369.
6. Pardo A, Gonzalez JEP, Pardo J, Juan AJ. Assessment of different casing materials for use as peat alternatives in mushroom cultivation: Evaluation of quantitative and qualitative production parameters. Spanish Journal of Agricultural Research 2004;2(2):267-272.
7. Patel Y, Naraian R, Singh VK. Medicinal properties of *Pleurotus* species (oyster mushroom) a review. World Journal of Fungal and Plant Biology 2012;3(1):1-12.
8. Peyvast GH, Shahbodaghi J, Remezani P, Olfati JA. Performance of tea waste as a peat alternative in casing materials for bottom mushroom (*Agaricus bisporus* (L.) Sing.) cultivation. *Biosci.* Biotech. Res. Asia 2011;4:1-6.
9. Rainey PB, Cole ALJ, Sanderson FR. Air filled pores, an important component of the mushroom casing layer. In: Proceeding of International Symposium Scientific and Technical Aspects of Cultivating Edible Fungi. The Pennsylvania State University Elsevier, Amsterdam 1986.
10. Sekhon GS, Chbba IM, Arora CL. Introduction to soil fertility (Part II) In: Soil science Laboratory Manual. College of Agriculture, Punjab Agricultural University, Ludhiana 1986.
11. Singh M. Global status of mushrooms. National web conference- Mushroom 2021 https://dmrsolan.icar.gov.in/abstractMSI2021.pdf