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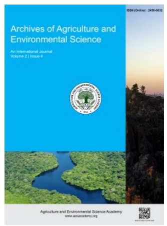

ORIGINAL RESEARCH ARTICLE

Effect of different casing materials on performance of white button mushroom (*Agaricus bisporus*) under controlled conditions in Banke district, Nepal

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ABSTRACT

Casing plays a crucial role in the cultivation of white button mushroom (*Agaricus bisporus*), as it initiates fructification, supports developing sporophores, and acts as a moisture reservoir essential for optimal yield and quality. The present study was conducted to evaluate suitable casing materials for enhanced production of white button mushroom under controlled conditions in Baijanath Rural Municipality, Banke district, Nepal. The experiment was laid out in a completely randomized design with six treatments and four replications under farmers' field conditions. The treatments comprised six casing formulations: 100% farmyard manure (FYM), 100% coco-peat, 50% coco-peat + 50% FYM (2 years old), 40% coco-peat + 50% FYM (2 years old) + 10% gypsum, 40% coco-peat + 50% garden soil + 10% gypsum, and 100% garden soil. Growth and yield parameters of *A. bisporus* were recorded and analyzed using R-Studio. Results revealed that casing materials significantly ($p \leq 0.05$) influenced days to pin-head formation, days to fruiting, pileus diameter, total yield (three flushes), and biological efficiency, whereas stipe length and stipe diameter were not significantly influenced. Early pin-head formation and fruiting of *A. bisporus* were observed in 100% FYM, which was statistically at par with 100% coco-peat. The highest pileus diameter, total yield, and biological efficiency were obtained with 100% FYM, followed by 100% garden soil. Based on the findings, 100% FYM is recommended as an effective casing material for maximizing yield and biological efficiency of *A. bisporus*. However, other casing formulations i.e. 100% garden soil and 100% Coco-peat could also be considered depending on local availability and soil variability.

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INTRODUCTION

The white button mushroom (*Agaricus bisporus*) is the most extensively cultivated edible fungus worldwide, accounting for nearly 40% of global mushroom production (Ghazaleh & Sassine, 2019). Commonly known as the European, temperate or table mushroom, it belongs to the Kingdom Fungi, Division Basidiomycota, Class Agaricomycetes, Order Agaricales and Family Agaricaceae. The genus *Agaricus* denotes gilled mushrooms known for its pleasant taste and aroma, while the species name *bisporus* refers to the presence of two basidiospores per basidium (Kumar *et al*., 2021a, b). This species is valued not only for its delicate flavor, and culinary versatility but also for its exceptional nutritional and therapeutic potential. Mushrooms are often referred to as "vegetable meat" and "white vegetables" due to their rich nutritional composition, which includes high levels of proteins, vitamins, essential amino acids, and carbohydrates, and very low fat content. Additionally, bioactive constituents such as polysaccharides, glycoproteins, phenolic compounds, triterpenoids, and nucleosides exhibit antimicrobial, antioxidant, antidiabetic, hepatoprotective, antihypertensive, and anticancer properties (Atila *et al*., 2017; Abah & Abah, 2010). The cultivation of *A. bisporus* is highly sensitive to environmental conditions, particularly temperature, humidity, and carbon dioxide concentration. Optimal vegetative growth occurs at 22–25 °C, while fructification requires cooler conditions of 14–18 °C, high relative humidity (85–90%) and controlled CO_2 levels (<0.15%) (Munshi *et al*., 2010). Among the various agronomic practices influencing productivity, casing represents a pivotal step in commercial mushroom production. Unlike most cultivated crops, *A. bisporus* requires a nutritionally poor but physicochemically suitable casing layer applied over fully colonized compost to stimulate the transition from vegetative mycelial growth to reproductive fruit body formation (Pardo González *et al*., 2002).

Casing serves as a biological and physical regulator of sporophore initiation by modifying the microenvironment at the compost surface. The casing layer stimulates primordia formation, supports uniform fructification, and enhances both yield and quality parameters. Its effectiveness depends largely on key physical and chemical attributes, including water-holding capacity, porosity, bulk density, pH, and electrical conductivity (Jarial *et al*., 2005). Furthermore, casing materials provide structural support, maintain optimal moisture, facilitate gaseous exchange, prevent compost desiccation, create low osmotic potential, and promote the activity of beneficial stimulatory microorganisms. Peat is widely regarded as ideal casing material because it has near neutral pH, high matter content, granular texture, maintains porosity even after repeated watering. However, its limited availability and environmental concerns necessitate evaluation of alternative locally available materials such as farmyard manure (FYM), garden soil, and coco-peat. A wide range of organic and mineral materials—such as well-decomposed farmyard manure (FYM), garden soil, peat, sand, and ash—have been evaluated as casing components, either singly or in combination (Colak *et al*., 2007). However, variability in locally available materials, differences in physicochemical properties, and inconsistencies in casing thickness often result in significant variation in crop performance (Dhar *et al*., 2012). Despite its critical importance, the optimization of casing composition and thickness remains a major challenge in achieving consistent productivity and superior fruit quality. Although various casing materials have been tested globally, inconsistent results due to regional variability in physicochemical properties highlight a significant research gap, particularly under Nepalese conditions. Given the increasing global demand for high-quality mushrooms and the need for cost-effective, locally adaptable cultivation practices, systematic evaluation of casing materials and their physicochemical properties is essential. Therefore, the present study was undertaken to evaluate different casing formulations and identify an effective, locally adaptable casing material for enhancing growth, yield, and biological efficiency of *Agaricus bisporus* under controlled conditions in Banke district, Nepal. The findings aim to provide practical recommendations for sustainable and cost-effective mushroom cultivation in the region. Therefore, this study was conducted to assess the effect of different casing materials on the performance of white button mushroom under controlled conditions.

MATERIALS AND METHODS

Study area and site selection

The study was conducted in Banke District, a Terai district of Province No. 5, Nepal located at 28°02'60'' N latitude and 81° 36'59.99'' E longitude, covering a total area of 2,337 km^2. The district is bordered by Bardiya to the west, Dang to the east, Salyan to the north, and the Indian state of Uttar Pradesh to the south. The region falls under a subtropical agro-climatic zone characterized by warm summers and mild winters, conditions suitable for seasonal cultivation of temperate mushrooms under controlled environments. Mushroom cultivation in Banke District has expanded rapidly in recent years due to increasing market demand and favorable climatic conditions. Recognizing its commercial potential, the Government of Nepal declared Baijanath Rural Municipality as a “Mushroom Block” in 2019, where mushroom cultivation spans approximately 100–500 hectares. The present study was conducted within this designated block area, located in the buffer zone of Banke National Park, which represents one of the emerging centers of commercial mushroom production in the district. The predominant soil type in the study area is silty loam, characterized by balanced texture, good aeration, high water-holding capacity, and substantial organic matter content. These properties are favorable for agricultural production and make locally available soil suitable as a component of casing mixtures. The site was purposively selected to evaluate the performance of different casing mixture proportions in button mushroom cultivation under the prevailing agro-climatic conditions of the Terai region. The selection of this commercially active mushroom block enhances the practical relevance of the study findings for farmers and stakeholders in the region.

Compost preparation and experimentation

Compost preparation is a critical step in the cultivation of white button mushrooms. Compost is a fermented, nutrient-rich substrate that supports the growth of mushroom mycelium and ultimately allows the mushrooms to develop. The compost was prepared using the short method of composting, which consists of two distinct phases: Phase I and Phase II, following the procedure described by (Munshi *et al*., 2010). During phase I, the raw materials were pre-wetted thoroughly and mixed under an open shed. All ingredients, except urea and gypsum, were initially combined and tightly heaped to promote anaerobic fermentation. After two days, the first turning was performed, during which urea was incorporated and the compact heap was loosened and reformed. A second turning was carried out two days later, at which time the pile was rebuilt without compression to encourage aerobic fermentation. Subsequently, 3–5 additional turnings were given at two-day intervals to ensure proper aeration, uniform decomposition, and heat distribution. The outdoor composting phase was completed within 10–12 days of pre-wetting. Phase II was conducted in a controlled environment chamber specifically designed for compost pasteurization. This stage, commonly referred to as peak heating, involved

Table 1. The details of the treatment used in the study.

Compost ingredients	Quantity/ Composition
Wheat straw	100 kg
Chicken manure	70 kg
Wheat bran	5.5 kg
Gypsum	7.5 kg
Urea	1.5 kg

maintaining the compost temperature between 45–60°C to eliminate harmful microorganisms, insects, and excess ammonia while promoting the growth of beneficial thermophilic microbes. This phase also lasted for 10–12 days. The compost was considered mature and ready for spawning after 23–25 days, indicated by the absence of ammonia odor, uniform dark brown color, and a friable texture. The details of the treatment used in the study are given in Table 1. The experiment was carried out in Completely Randomized Design (CRD) during the study. Formulation of the compost for button mushroom production with substrate used were.

Spawning: It is the process of mixing compost with mushroom mycelium. After the nutritionally suitable compost for spawning was ready, it was taken out from the pasteurization chamber and was filled into perforated plastic bags of 10 kilograms each. Spawn was incorporated at a rate of 0.5-0.75% by weight and mixed thoroughly to ensure uniform colonization.

Casing: Biologically inert materials were applied as a surface layer over fully colonized compost known as casing to stimulate sporophore formation. The casing material was disinfected with formalin prior to application to minimize contamination. Casing provides the essential physical, chemical and biological conditions required for pinhead initiation and uniform fruit body development. Complete spawn run occurred within 10–15 days after spawning, following which the casing layer was applied. The casing temperature was maintained at 24–25°C during case-run and subsequently reduced to 14–16°C after full colonization to induce fruiting. Relative humidity was maintained at 85–90% throughout the cropping period. Case-run commenced immediately after casing application. The casing mixture was prepared by incorporating gypsum (4 kg), lime (600 g), formalin (600 ml), and Bavistin (60 g) into the base material to improve its physicochemical properties and ensure disinfection prior to application.

Observation and data collection

Data was collected from the day of spawning to the first emergence of fruiting bodies. Stipe length, stipe diameter, pileus diameter, yield of first flush, yield of second flush, yield of third flush, biological efficiency of mushroom per kg substrate (on dry wt. basis) under different casing. Five samples were collected from each bag during harvest to calculate the stipe length, stipe diameter and pileus diameter. The average of five samples was taken for data analysis.

Biological efficiency: Biological efficiency of substrate was calculated using following formula:

$$\text{B. E. (\%)} = \frac{\text{Fresh weight of mushroom}}{\text{Dry weight of substrate}} \text{X100}$$

Data analysis

The recorded data were entered into Microsoft Excel and subsequently analyzed using the R-STAT statistical software package. The data were subjected to one-way analysis of variance (ANOVA) to determine the significance of treatment effects. When significant differences were detected, treatment means were separated using Duncan's Multiple Range Test (DMRT) at the 5% level of significance ($p \leq 0.05$). The effectiveness of the treatments was evaluated based on the measured growth, yield, and biological efficiency parameters.

RESULTS AND DISCUSSION

The results of this study are presented in Tables 2-5. In the present study, different casing materials were evaluated for the cultivation of button mushroom, with yield and biological efficiency serving as the principal parameters for assessing treatment performance. The highest yield was recorded with 100% farmyard manure (FYM) as casing material, producing 2439.83 g in the first flush, 1304.97 g in the second flush, and 696.68 g in the third flush. Correspondingly, the maximum biological efficiency (14.44%) was also obtained under this treatment.

Number of days to pinhead formation

During the study, casing materials significantly ($p \leq 0.05$) influenced the number of days to pinhead formation in *A. bisporus* (Table 2). The earliest primordia appeared in 100% FYM (29.25 days), which was statistically at par with 100% coco-peat (30 days). Moderate pinhead initiation was observed in 100% garden soil (32.25 days) and 40% coco-peat + 50% FYM (2-year-old) + 10% gypsum (32.75 days) whereas the slowest pinning occurred in 40% coco-peat + 50% garden soil + 10% gypsum (34 days) and 50% coco-peat + 50% FYM (34.25 days). Rapid pinhead formation in FYM and coco-peat treatments may be attributed to their optimal moisture retention, better aeration, and enhanced microbial activity, which create favorable conditions for primordia induction. Casing layers regulate water availability and gas exchange, both essential for fruit body initiation (Noble *et al.*, 2003). FYM likely maintained favorable CO_2 gradients and oxygen diffusion necessary for triggering reproductive differentiation. In contrast, higher proportions of garden soil likely reduced porosity and oxygen diffusion, thereby delaying pinning. These findings are consistent with Sassine *et al.* (2005), who reported significant variation in pinhead emergence depending on casing composition. Rehman *et al.* (2016) observed earlier pinning in organic-rich casing substrates compared to soil-dominant mixtures. Dehariya & Jain (2025) also observed that FYM accelerated pinhead formation due to its ability to maintain optimal CO⍰ concentration and microbial equilibrium. Earlier pinhead formation shortens the cropping cycle, allows earlier harvesting, and improves production efficiency, making FYM and coco-peat suitable casing alternatives under controlled conditions.

Table 2. Influence of treatments on pinhead formation of *A. bisporus* under controlled conditions.

Treatments	No. of days to pinhead formation
100% FYM (2 years old)	29.25[c]
100% Coco-peat	30.00[c]
50% Coco-peat + 50% FYM (2 years old)	34.25[a]
40% Coco-peat + 50% FYM (2 years old) + 10% Gypsum	32.75[b]
40% Coco-peat + 50% Garden Soil + 10% Gypsum	34.00[a]
100% Garden Soil	32.25[b]
SEm(±)	0.353553
LSD(α=0.05)	1.050461
CV	2.203969
F test (α=0.05)	33.933
p-value	1.48e-08 ***
Grand mean	32.08333

Table 3. Influence of treatments on fruiting of *A. bisporus* under controlled conditions.

Treatments	No. of days to Fruiting
100% FYM (2 years old)	36.75[c]
100% Coco-peat	37.75[c]
50% Coco-peat + 50% FYM (2 years old)	41.50[a]
40% Coco-peat + 50% FYM (2 years old) + 10% Gypsum	40.00[b]
40% Coco-peat + 50% Garden Soil + 10% Gypsum	41.75[a]
100% Garden Soil	37.75[c]
SEm(±)	0.527044
LSD(α=0.05)	1.565927
CV	2.685573
F test (α=0.05)	16.29
p-value	3.939e-06 ***
Grand mean	39.25

Note: SEm±, Standard Error of mean; CV, Coefficient of variation; LSD, Least significant difference. Means in the column with same letter (s) in superscript indicate no significant difference between treatments at 0.05 level of significance; '***' Significant at 0.001 level of Significance.

Number days to fruiting

The number of days to fruiting in *A. bisporus* was highly significantly ($p \leq 0.05$) influenced by different casing materials (Table 3). The earliest fruiting was observed in 100% FYM (36.75 days), which was statistically at par with 100% coco-peat and 100% garden soil (37.75 days). Fruiting was slightly delayed in 40% coco-peat + 50% FYM (2-year-old) + 10% gypsum (40 days) while the latest fruiting occurred in 50% coco-peat + 50% FYM (41.50 days) and 40% coco-peat + 50% garden soil + 10% gypsum (41.75 days), which were statistically similar. The earlier fruiting observed in FYM-based casing may be due to its sustained moisture supply, improved aeration, and microbial activity, which promote rapid mycelial differentiation and fruit body development. Proper casing structure enhances gaseous exchange and maintains favorable microclimatic conditions required for reproductive growth. Conversely, soil-dominant mixtures may have reduced porosity and slowed physiological development, resulting in delayed fruiting. Similar trends were reported by Kumar *et al.* (2020a) and Dehariya & Jain (2025), who found that FYM-based casing reduced the time to fruiting compared to compact or synthetic mixtures. Earlier fruiting shortens the production cycle, facilitates timely harvesting, and improves economic returns. Therefore, FYM and coco-peat appear to enhance crop earliness and production efficiency in *A. bisporus* cultivation.

Stipe length and stipe diameter

The stipe length and stipe diameter in *A. bisporus* were not significantly ($p > 0.05$) influenced by the different casing materials, indicating that these morphological traits are relatively stable under controlled environmental conditions (Table 4). Although differences were non-significant, the highest stipe length was recorded in 100% FYM, while the lowest was observed in 50% coco-peat + 50% FYM. Similarly, the greatest stipe diameter was obtained in 100% coco-peat, whereas the lowest was recorded in 40% coco-peat + 50% FYM (2-year-old) + 10% gypsum. This suggests that stipe morphology is primarily governed by genetic factors and overall environmental conditions (temperature, humidity, and CO_2 concentration) rather than casing composition alone. Similar observations were reported by Kerketta *et al.* (2019) and Kumar *et al.* (2020b), who noted limited influence of casing variation on stipe dimensions. Casing mainly influences moisture regulation and fruit body initiation, while morphological dimensions such as stipe length and thickness remain relatively stable under controlled growing conditions.

Pileus diameter

The pileus diameter of *A. bisporus* was found to be highly significantly ($p \leq 0.05$) affected by the different casing material treatments. The largest pileus diameter (8.11 cm) was recorded in the treatment with 100% FYM (2-year-old), which was statistically at par with 100% garden soil (7.62 cm). This was followed by 100% coco-peat, which showed statistical similarity with the mixture of 40% coco-peat + 50% garden soil + 10% gypsum (6.67 cm). The smallest pileus diameter (6.28 cm) was observed in the treatment comprising 50% coco-peat + 50% FYM (2-year-old), which was statistically at par with 40% coco-peat + 50%

Table 4. Influence of treatments on stipe length, stipe diameter, pileus diameter of *A. bisporus* under controlled conditions.

Treatments	Stipe length	Stipe diameter	Pileus diameter	No. of days to Pinhead formation
100% FYM (2 years old)	1.560	1.870	8.110[a]	29.25[c]
100% Coco-peat	1.290	1.885	6.9700[b]	30.00[c]
50% Coco-peat + 50% FYM (2 years old)	1.045	1.720	6.2800[c]	34.25[a]
40% Coco-peat + 50% FYM (2 years old) + 10% Gypsum	1.375	1.680	6.4550[c]	32.75[b]
40% Coco-peat + 50% Garden Soil + 10% Gypsum	1.365	1.775	6.6725[bc]	34.00[a]
100% Garden Soil	1.335	1.845	7.620[a]	32.25[b]
SEM(±)	0.131149	0.082974	0.166861	0.353553
LSD(α=0.05)	0.389663	0.2465296	0.4957686	1.050461
CV	19.74636	9.240768	4.755278	2.203969
F test (α=0.05)	1.6161	1.0304	18.233	33.933
p-value	0.2064[ns]	0.4296[ns]	1.747e-06 ***	1.48e-08 ***
Grand mean	1.328333	1.795833	7.017917	32.08333

Note: SEm±, Standard Error of mean; CV, Coefficient of variation; LSD, Least significant difference.

Table 5. Influence of treatments on yield and biological efficiency of *A. bisporus* under controlled conditions.

Treatments	1st flush	2nd flush	3rd flush	Biological efficiency (B.E.) %
100% FYM (2 years old)	2439.825[a]	1304.967[a]	696.6825[a]	14.44
100% Coco-peat	2290.175[b]	1200.592[b]	628.9375[b]	13.4
50% Coco-peat + 50% FYM (2 years old)	2019.775[c]	1013.567[c]	496.8150[c]	11.48
40% Coco-peat + 50% FYM (2 years old) + 10% Gypsum	2075.325[c]	1023.017[c]	503.6550[c]	11.71
40% Coco-peat + 50% Garden Soil + 10% Gypsum	2283.850[b]	1189.233[b]	633.4[b]	13.37
100% Garden Soil	2350.625[ab]	1252.740[ab]	662.8250[ab]	13.89
SEM(±)	40.58633	21.56386	13.82118	
LSD(α=0.05)	120.5882	64.06951	41.06483	
CV	3.618509	4.785789	4.578678	
F test (α=0.05)	16.045	18.299	36.745	
p-value	4.387e-06***	1.702e-06***	7.802e-09***	
Grand mean	2243.262	1164.02	603.7192	

Note: SEm±, Standard Error of mean; CV, Coefficient of variation; LSD, Least significant difference. Means in the column with same letter (s) in superscript indicate no significant difference between treatments at 0.05 level of significance; '***' Significant at 0.001 level of Significance.

FYM (2-year-old) + 10% gypsum (6.46 cm) and 40% coco-peat + 50% garden soil + 10% gypsum (6.67 cm). Larger pileus size under FYM may be attributed to improved water availability and balanced nutrient supply, which support cell expansion during cap development. Cap diameter is strongly influenced by water transport efficiency within the fruit body, which is indirectly affected by casing moisture dynamics. Recent studies (Rehman *et al.*, 2016; Kaur *et al.*, 2017) reported similar enhancement in pileus diameter with nutrient-rich organic casing materials, supporting the present findings.

Yield during 1st, 2nd and 3rd flushes and the biological efficiency of casing materials

The yield in *A. bisporus* during 1st, 2nd and 3rd flushes was found highly significantly influenced by the treatments involving different casing materials (Table 5). The highest yield at first flush was observed in treatment with 100% FYM (2 years old) (2439.825 g) which is significantly at par with 100% garden soil (2350.625 g). It was followed by 100 % coco-peat (2290.175 gm) which is statistically similar with 40% coco-peat + 50% garden Soil + 10% Gypsum (2283.850 g). The lowest yield was observed in 50% coco-peat + 50% FYM (2 years old) (2019.775 g) which is statistically similar with 40% coco-peat + 50% FYM (2 years old) + 10% Gypsum (2075.325 g). Similarly, the highest yield at second flush was observed in treatment with 100% FYM (2 years old) (1304.967 g) which is significantly similar with 100% garden soil (1252.740g). It was followed by 100 % Coco-peat (1200.592 g) which is statistically similar with 40% coco-peat + 50% Garden Soil + 10% Gypsum (1189.233 g). The lowest yield was reported in 50% coco-peat + 50% FYM (2 years old) (1013.567 g) which is statistically similar with 40% Coco-peat + 50% FYM (2 years old) + 10% Gypsum (1023.017 g). Furthermore, the highest yield at third flush was observed in treatment with 100% FYM (2 years old) (696.6825 g) which is significantly similar with 100% garden soil (662.8250 g). It was followed by 100 % coco-peat (628.9375 g) which is statistically similar with 40% coco-peat + 50% garden soil + 10% Gypsum (633.4 g). The lowest yield was reported in 50% coco-peat + 50% FYM (2 years old) (496.8150 g) which is statistically similar with 40% coco-peat + 50% FYM (2 years old) + 10% Gypsum (503.6550 g). Biological efficiency of casing material was highest in 100% FYM (14.44%), followed by 100% garden soil (13.89%), 100% coco-peat (13.4%), 40% coco-peat + 50% garden soil + 10% Gypsum (13.37%). The lowest BE was observed in 50% coco-peat+ 50% FYM (11.48%), closely followed by 40% coco-peat + 50% FYM (2 years old) + 10% Gypsum (11.71%). Lower BE in mixed treatments suggests that structural imbalance or reduced aeration may have limited nutrient mobilization and fruit body development. Several researchers have reported that casing composition significantly influences yield performance of *A. bisporus*. Bhatt *et al.* (2006) evaluated seven casing mixtures prepared from FYM, spent compost, vermicompost, coir pith, and press mud, and reported significant variation in yield among treatments. Similarly, Pardo *et al.* (2004) compared five casing materials to identify suitable alternatives to peat and highlighted the importance of casing composition in determining both quantitative and qualitative production parameters. Kerketta *et al.* (2019) further confirmed that the physicochemical properties of casing layers strongly determine crop performance. The superior performance of 100% FYM observed in the present study aligns with earlier findings. Rehman *et al.* (2016) and Dehariya & Jain (2025) reported maximum yield and biological efficiency in FYM-based casing, attributing this affect to improved microbial synergy, enhanced aeration, and regulation of CO_2 concentration at the compost-casing interface. Organic casing materials are known to harbor beneficial microorganisms that produce growth -promoting metabolites responsible for primordia induction (Pardo *et al.*, 2004). Enhanced microbial balance facilitates the transition from vegetative to reproductive growth by maintaining appropriate oxygen diffusion and CO_2 gradients (Noble *et al.*, 2003). Furthermore, FYM-based casing may contribute essential nutrients such as N, P, Fe, Cu, and Zn (Singh *et al.*, 2000), which potentially stimulate metabolic activity and fruit body development. Higher biological efficiency under organic casing reflects improved conversion of compost substrate into mushroom biomass, supported by optimal moisture retention and mycelial respiration (Royse, 2014). Pardo-Giménez *et al.* (2011) reported enhanced productivity under peat and organic casing materials due to favorable microclimatic regulation. The comparable performance of 100% garden soil in the present study may be attributed to its silty-loamy texture and adequate water-holding capacity, characteristics previously associated with effective casing performance (Jarial *et al.*, 2005).

Conclusion and recommendation

The result obtained from different casing materials used in the experiment has demonstrated the suitability of re-incorporating alternative materials in mushroom cultivation. This would be an important and effective alternative in the commercial operation of mushroom industry as an alternative to sphagnum peat which has difficulty associated with its availability as well as its high cost. Among the evaluated treatments, 100% FYM consistently exhibited superior performance in terms of early pinning, enhanced yield, and higher biological efficiency. Since the casing materials are shown to have significant influence on yield of *A. bisporus*, it is important to select locally available casing materials to meet the increasing demand. In context of Banke district, FYM is available easily and at a relatively low cost, thus making it a better choice as a casing material in production of *A. bisporus*. Similarly, the effectiveness of garden soil is also found to be significantly similar with FYM. But the use of garden soil is limited to the site where the research trial was carried out as the type and characteristics of soil differs geographically. So, FYM can be used as casing variable for the production of *A. bisporus*. Researches can further be conducted on the use of various locally available materials to harness the yield potential as well as biological efficiency of button mushroom as an alternative to sphagnum peat.

DECLARATIONS

Author contribution statement: Conceptualization: A.D. and N.K.C. Methodology: A.D. and N.K.C.; Software and Validation: A.D. and N.K.C.; Formal Analysis and Investigation: A.D.; Resources: A.D.; Data Curation: A.D. and N.K.C.; Writing – Original Draft Preparation: A.D.; Writing – Review and Editing: N.K.C.; Visualization, Supervision, Project Administration, Funding Acquisition: A.D. All authors have read and approved the final version of the manuscript.

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