Evaluation of selected substrates for growth and yield parameters of split gill mushroom (*Schizophyllum commune*)

ABSTRACT

Schizophyllum commune is an edible mushroom found growing on wood under natural natural conditions. This study aimed to evaluate the growth and yield parameters of split gill *Schizophyllum commune.* This research work was undertaken at mushroom crop room in Department of Plant pathology, Sam Higginbottom University of Agriculture, Technology and Sciences, SHUATS, Naini, Prayagraj. The experiment was laid out in a Completely Randomized Design under the agro-climatic conditions of Prayagraj (2023-24). *S. commune* was cultivated on lignocellulosic substrates *viz*., sawdust, paddy straw and wheat straw with and without wheat bran supplementation. Treatments, T_0 sawdust (control),T_1-sawdust (500g) + wheat bran (250g) + $CaCO_3$(10g) + $MgSO_4$ (1g), T_2 - wheat straw (500g) + wheat bran (250g) + $CaCO_3$(10g) + $MgSO_4$(1g), T_3 - paddy straw (500g) + wheat bran (250g) + $CaCO_3$(10g) + $MgSO_4$ (1g), T_4- saw dust (750g) + $CaCO_3$(10g) + MgSO4 (1g), T_5 - wheat straw (750g) + $CaCO_3$(10g) + $MgSO_4$ (1g) and T_6 - paddy straw (750g) + $CaCO_3$(10g) + $MgSO_4$(1g). The results revealed that among the selected treatments T_1-saw dust (500g) + wheat bran (250g) + $CaCO_3$(10g) + $MgSO_4$(1g) took minimum number of days for spawn run (7.56 days), pinhead initiation (12.09 days), mature fruiting body formation (14.78days), maximum yield (75.85g) and biological efficiency (%) (102.7).

Keywords*:* Biological efficiency, Paddy straw, *S*. *commune*, Sawdust, Wheat straw, Yield.

1. INTRODUCTION

Schizophyllum commun belongs to the family of schizophyllaceae of order Agaricales. It is an edible white rot fungus naturally growing on decaying wood during the rainy season. The genus Schizophyllum means “split gill” and thus the mushroom is called as split gill mushroom. The fruiting body of *S. commune* is characterized as tiny, elastic, tough flabelliform (fan shaped) white stripe-less cap with hairy wet split gill. The fruiting body usually wrinkled at the upper surface, fan to shell-shaped with short striped and grey-white to brown in colour **(Yim *et al*., 2013)**. The fruiting can be solitary or in cluster on decaying wood **(Rosnan *et al*., 2019).** *S*. *commune* is renowned for having high levels of fat, protein, vitamins, and minerals. it is rich in P, Mg, K, and Se has a high dietary fibre content of more than 50% of the net weight **(Ghorai *et al*., 2009)**. Split gill mushroom consumed as food and medicine in numbers of nation including Korea, Malaysia, China, Thailand, Vietnam and North East India, this fungus is popular in Mexico and other tropical places (Singh *et al*., 2021). *S. commune* extract has the ability to treat disease caused by bacteria and fungi, making it a potential antibacterial agent **(Mirfat *et al*., 2014)**. *S. commune* produce a natural polysaccharide schizophyllan which has

considerable medicinal properties have capable factor for the prevention of human infirmity **(Ooi and Liu, 1999); (Wasser, 2002)**.
Substrates types is one the essential factors in mushroom cultivation because the soluble inorganic and organic materials originating from the substrate will be absorbed as nutrients by the mushrooms for growth and the development of fruiting bodies **(Choi *et al.,*2004)**. A good substrate should have sufficient nitrogen (e.g., via addition of nitrogen supplement) and carbohydrate contents to support and facilitate mushroom growth **(Ogundele *et al*., 2014)**.
These includes a variety of substrates derived from agriculture waste materials such as saw dust, paddy straw, wheat straw, paper waste, sugarcane bagasse, coconut coir which support the growth and development of fruiting of mushroom however, supplementation of substrates with various material like wheat bran, rice bran was recommended prior to spawning for enhancement of yield of mushroom **(Rashid *et al*., 2016).** Thus, the present study aimed to evaluate the effect of selected substrates for growth and yield parameters of split gills mushroom.

2. MATERIALS AND METHOD

2.1 Site of study

The present experiment was carried out at the Laboratory and Mushroom Crop Room, Department of Plant Pathology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India (211007) during October 2023 to April 2024. The maximum temperature reaches up to 47ºC in summer and drops down to 2.5℃ in winter.

2.2 Treatments

The substrates selected for the cultivation of split gill mushroom were sawdust, paddy straw, wheat straw, with and without wheat bran supplementation each weighing 750g. The experimental design was laid out in a Completely Randomized Design (CRD). Seven treatments were replicated five times thus making total 35 bags. The treatment combination were as follow T_1 [Saw dust(500g) + Wheat bran(250g) +$CaCO_3$(10g) +$MgSO_4$(1g)], T_2 [Wheat straw(500g) +Wheat bran (250g) +$CaCO_3$(10g) +$MgSO_4$(1g)], T_3 [Paddy straw(500g) + Wheat bran(250g) + $CaCO_3$(10g) +$MgSO_4$(1g)], T_4 Sawdust(750g) + $CaCO_3$(10g) + $MgSO_4$(10g)], T_5 [Wheat straw(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)], T_6 [Paddy straw(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)] as compared to T_0 - (control).

2.2 Substrate preparation

The paddy grain spawn of *S. commune* was procured from commercial mushroom production unit Imphal west, Manipur. 795001.

2.3 Substrate preparation

S. commune was cultivated on lignocellulosic substrate like saw dust, paddy straw, wheat straw. Paddy straw, wheat straw was chopped into 3-5 cm pieces. Sawdust of mango (*Mangifera indica*) was obtained from industrial area of Prayagraj and wheat bran obtained from local rice mill. The substrates paddy straw and wheat straw were soaked in water to get fully wet and then treated with a solution of formalin (0.5%) and carbendazim (0.075%) after sterilization, straw was taken out and excess water was drained and spread out in a plastic sheet as a thin layer. The straw was left for 2-3 hours to obtain (60-65%) moisture capacity.

(Jiskani *et al*., 2007). Sawdust and wheat bran were filled in the polypropylene bags and autoclaved at 121°C at 15 lbs pressure for an hour and allowed to cool down. $CaCO_3$ (2%) and $MgSO_4$ (0.02%) were mixed with the substrates before spawning to maintain the pH. Spawning was done at the rate of 40g per 750g of wet substrates. The bags were subsequently placed long side down, into a mushroom crop room at 20 -30℃ in dark room and 65-70 % relative humidity until completion of mycelial run. After colonization, the polythene bags were cut and removed and water was sprayed to maintain the moisture. The mature fruiting bodies were harvested by hand picking in clock wise or anti-clock wise rotation before spraying of water.

3. Results and discussion

3.1 Days taken for mycelium running rate

The data has been depicted in the table 1, illustrated in figure 1 data revealed that number of days taken for spawn run of split gill mushroom was minimum in treatment T_1-[Saw dust(500g) + Wheat bran(250g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (7.56 days) followed by mT_3 - [Paddy straw(500g) + Wheat bran(250g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (8.510days), T_4 - [Saw Dust(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (8.62 days), T_6 - [Paddy straw(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (8.64 days), T_2 - [Wheat straw(500g) + Wheat bran(250g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (9.17 days), T_5 - [Wheat straw(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (10.01 days) as compared T_0 (control) Saw dust (11.01 days).

3.2 Days taken for primordial initiation

The data presented in the table 1, depicted in figure 1 revealed that number of days taken for pin head initiation of split gills mushroom was significantly minimum in treatment T_1-[Sawdust(500g) + Wheat bran(250g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (8.21 days) followed by T_3 - [Paddy straw(750g) + Wheat bran (250g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (8.96 days), T_6- [Paddy straw (500g) + $CaCO_3$(10g) + $MgSO_4$(1g)](9.76 days), T_4 - [Saw Dust (750g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (10.070days), T_2 - [Wheat straw(500g) +Wheat bran(250g) + $CaCO_3$(10g) +MSO_3(1g)] (10.83 days), T_5- [Wheat straw(750gm) + $CaCO_3$(10g) + $MgSO_4$(1g)] (11.05 days) as compared to T_0 (control)(12.09 days).

3.3 Days taken for formation of fruiting bodies

The data presented in the table 1, depicted in figure 1 revealed that that number of days taken for maturation of fruiting bodies of split gills mushroom was significantly minimum in treatment T_1- [Sawdust(500g) + Wheat bran(250g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (14.78 days) followed by T_3 - [Paddy straw (500g) + Wheat bran (250g) + $CaCO_3$ (10g) + $MgSO_4$ (1g)] (15.54 days), T_6 - [Paddy straw (750g) + $CaCO_3$ (10g) + $MgSO_4$(1g)] (16.25 days), T_4 - [Saw Dust (750g) + $CaCO_3$ (10g) + $MgSO_4$ (1g)] (16.25 days), T_5- [Wheat straw(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (17.09 days), T_2 - [Wheat straw(500gm) +Wheat bran(250gm) + CaCO3(10g) + MgSO4(1g)] (17.16 days), as compared to T_0 (control) (18.05 days).

As per findings from this study, the minimum days taken spawn run, pin head initiation and fruiting body formation was observed in T_1- [Sawdust(500g) + Wheat bran(250g) + $CaCO_3$(10g) + $MgSO_4$(1g)]. The probable reason for this result may be due to the presence of right proportion of alpha cellulose, hemicellulose and lignin in sawdust which may have helped in higher rate of mycelium run and pinhead formation in split gill mushroom **Das *et al*. (2013).** Water holding capacity and porosity of saw dust substrates may have helped in

efficiently respiration of mycelium and easy accessed for enzyme to the nutrient present in the substrates. Thus may have helped in resulting in better mycelium development and pinhead formation of split gill mushroom **Osunde *et al*. (2019)**. The C:N ratio of saw dust and wheat bran supplement may have helped supplied the extra nitrogen and easily degradable carbohydrates to the substrates which may helped fruiting body development **Oseni *et al*. (2012)** and **Ashrafuzzaman *et al*. (2009)**. $CaCO_3$ helped in enhancement of pH of substrates which may helped in rapid mycelia colonisation and fruiting body formation of the split gill mushroom **Ghareeb, (2019).**

Table 1. Effect of selected substrates on number of days taken for mycelium run, pin head initiation, fruiting bodies formation

Treatments	Mycelium run (days)	Pin head Initiation (days)	Fruiting bodies formation (days)
T_0- Control (untreated checked)	11.01[a]	12.09[a]	18.05[a]
T_1- Saw dust(500g) + Wheat bran(250g) +$CaCO_3$(10g) +$MgSO_4$(1g)	7.56[e]	8.21[e]	14.78[e]
T_2- Wheat straw(500g) +Wheat bran (250g) +$CaCO_3$(10g) +$MgSO_4$(1g)	9.17[c]	10.83[b]	17.16[b]
T_3- Paddy straw(500g) + Wheat bran(250g) +$CaCO_3$(10g) +$MgSO_4$(1g)	8.51[d]	8.96[d]	15.54[d]
T_4- Sawdust(750g) + $CaCO_3$(10g) + $MgSO_4$(10g)	8.62[d]	10.07[c]	16.25[c]
T_5- Wheat straw(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)	10.01[b]	11.05[b]	17.09[b]
T_6- Paddy straw(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)	8.64[d]	9.76[c]	16.25[c]
CD (5%)	**0.52**	**0.68**	**0.70**

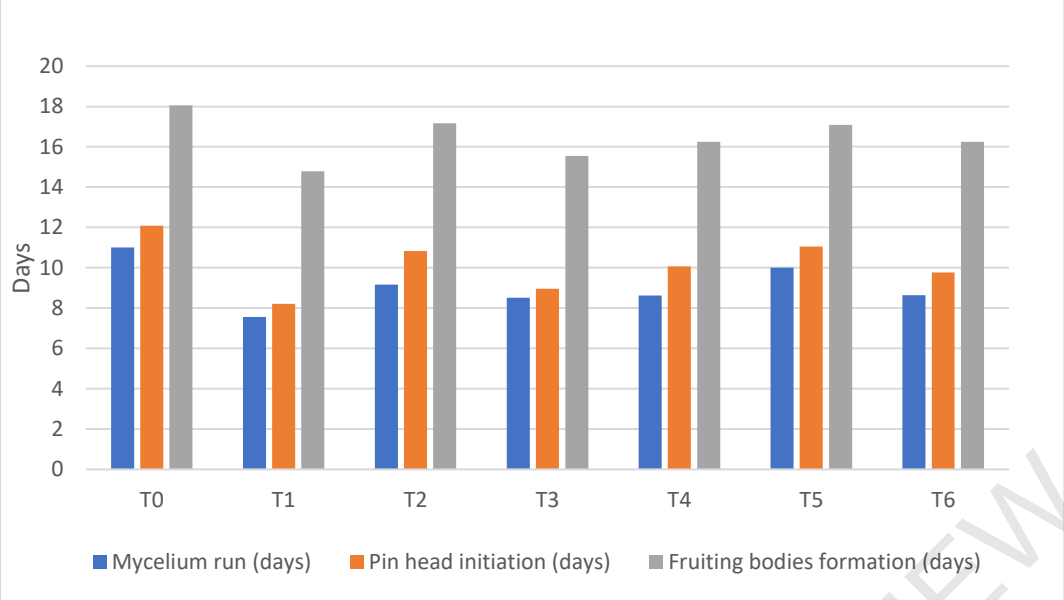

Figure. 1 Effect of selected substrates on number of days taken for mycelium run, pin head initiation, fruiting bodies formation

3.4 Yield (g)

The data presented in the table 2, depicted in figure 2 revealed that average yield (g) of split gill mushroom significantly increased in treatment T_1 - [Saw dust(500g) + Wheat bran(250g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (75.00 g) followed by T_3-[Paddy straw(500g) + Wheat bran(250gm) + $CaCO_3$(10gm) + $MgSO_4$(1g)] (74.15 g) , T_4 - [Saw Dust(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (72.64g), T_2 - [Wheat straw(500g) + Wheat bran(250g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (70.93g), T_6 - [Paddy straw(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (70.21g), T_5- [Wheat straw (750g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (70.06 g) as compared to T_0 (control) (68.6g) .

As per findings from this study, T_1 - [Saw dust(500g) + Wheat bran(250g) + $CaCO_4$(10g) + $MgSO_4$(1g)] recorded the maximum yield of *Schizophyllum commune* mushroom. The probable reason of this result may be due to the break-down of lignin present in the sawdust. The degradation of lignin and the production of phenolases which may have helped in oxidized phenolic compounds to simple aromatic compounds that may have helped in absorbed by mushroom mycelium and may have helped in increased growth and yield of spilt gills mushroom. The cellulolytic action of simple and soluble carbohydrates may have helped in production of glucose which was absorbed by the fungal mycelium which may have helped in growth and increased yield of spilt gills mushroom. High cellulose content in sawdust may have helped in enhancement of cellulose enzyme production that may have helped in increased yield of split gills mushroom **Ashrafuzzaman *et al*. (2009).** The wheat bran may have helped in supplied the extra nitrogen and easily degradable carbohydrates to the substrate which may have helped in increased mushroom yield and biological efficiency **Oseni *et al.* (2012)**. Similar findings were also reported by **Shah *et al*. (2004)** on maximum yield and biological efficiency in sawdust substrates.

3.5 Biological efficiency (%)

The data presented in the table 2, depicted in figure 2 revealed that biological efficiency of split gill mushroom substrates significantly increased in treatment T_1- [Saw dust(500g) + Wheat bran(250g) + $CaCO_4$(10g) + $MgSO_4$(1g)] (102.7%) followed by T_3-[Paddy straw(500g) + Wheat bran(250g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (92.0%), T_5- [Wheat straw(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (81.33%), T_4 - [Saw Dust(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)] (83.4%), T_2 - [Wheat straw(500g) +Wheat bran(250g) + $CaCO_3$(10g) +$MgSO_4$(1g)] (76.1%), T_6 - [Paddy straw(750g) + $CaCO_4$(10g) + $MgSO_4$(1g)] (69.83%), as compared to T_0 (control) (52.93%).

Table 2. Effect of selected substrates on yield and biological efficiency of *S. commune*

Treatments	Yield (g)	Biological efficiency (%)
T_0- Control (untreated checked)	68.60	52.93
T_1- Saw dust(500g) + Wheat bran(250g) +$CaCO_3$(10g) +$MgSO_4$(1g)	75.85	102.7
T_2- Wheat straw(500g) +Wheat bran (250g) +$CaCO_3$(10g) +$MgSO_4$(1g)	70.93	76.12
T_3- Paddy straw(500g) + Wheat bran(250g) +$CaCO_3$(10g) +$MgSO_4$(1g)	74.15	92.0
T_4- Sawdust(750g) + $CaCO_3$(10g) + $MgSO_4$(10g)	72.64	83.4
T_5- Wheat straw(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)	70.67	81.33
T_6- Paddy straw(750g) + $CaCO_3$(10g) + $MgSO_4$(1g)	70.21	69.83
CD (5%)	**1.21**	**1.98**

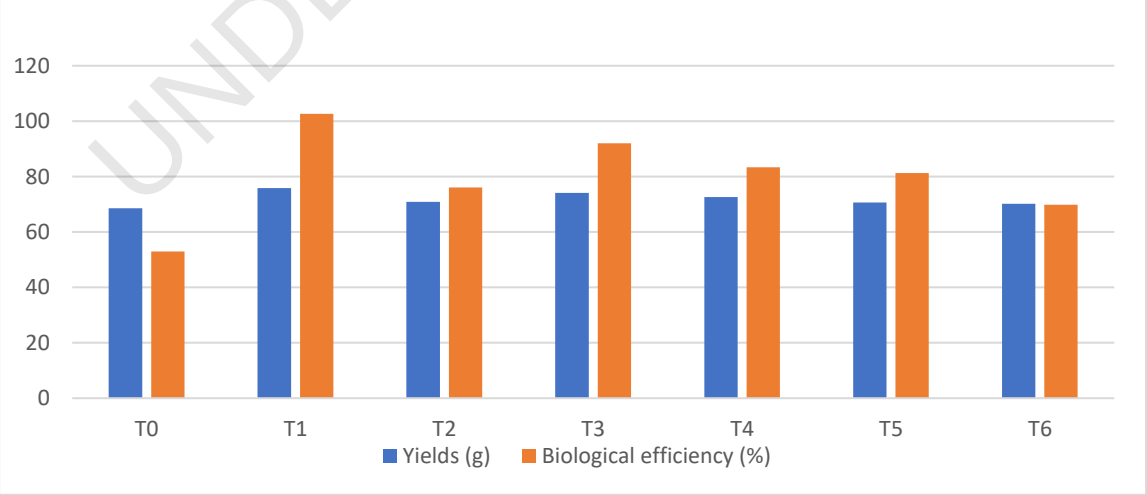

Figure 2. Effect of selected substrates on yield and biological efficiency of *S. commune*

4. CONCLUSION

From the present study, it can be concluded that among the selected treatments T_1- sawdust (500g) + wheat bran (250g) + $CaCO_3$ (10g) + $MgSO_4$(1g) exhibited the best results in terms of spawn run (days), pin head initiation (days), fruiting bodies formation (days), maximum yield (g) and biological efficiency (%). It is worth mentioning that the conclusions drawn from this study are based on observations made during a specific cropping season spanning October 2023 to November, within the agro - climatic conditions of Prayagraj. As such, further research and more experimentation over many seasons should be conducted in future for further recommendations.

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