Studies on Growth Behavior and Yield Performance of Lentinulaedodes (Berk) Peglar

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Abstract: The study was aim to investigate various agro-wastes (Sawdust, wheat straw, paddy straw, sorghum straw, finger millet straw and pearl millet straw) in mixture found locally for cultivation of Lentinula edodes-327.With respect to this 5 substrates were tested on the basis of growth parameters and yield performance. Results based on the current study revealed that T1 had the shortest spawn run and bump formation time (54.75 days 32.50 days), while T1 display shortest browning period time (8.50 days). The minimum total incubation time was 95.75 and 106.00 days by T1 and T2, Stipe diameter was maximum in T3 (2.46 cm) and minimum in T5 (1.41cm). T1 had the longest stipe and cap diameter of 4.32 cm and 8.24 cm respectively whereas T1 had the thickest cap (3.54 cm). The highest yielding substrate in 1st flush was T3 (287.7 gm), 2nd flush (175.23 gm) and 3rd flush (107.70 gm).The highest biological efficiency rate is 28.54% by T3 followed by T1 (22.46%).

Keyword: Shiitake Spawn Run, Browning Stage, Pinhead Formation, Substrates, Flush Yield, and Biological Efficiency.

Introduction

Shiitake mushrooms also known as Lentinulaedodes, is the most consumed and grown mushroom worldwide, display its solitary taste, aroma, nutritional as well as medicinal properties (Li and Xu 2022; Ahmad et al. 2023). They are grown on agricultural-industrial waste according to the composition needed for their growth substrate, which is having a direct influence on mycelial growth, enzymatic activity, fruiting body, yield and quality. There is diverse preference for substrates based on strains of Lentinulaedodes, impacting their biological efficiency and yielding parameters (Annepuet al., 2019). The selection of an suitable cultivar is most dominate, as mycelial growth and browning stages display prominent biological events influenced by interaction of the strain and

substrate (Song et al., 2025). This interaction is decisive as it directly affects the decay of complex lignocellulosic substrates, which are vital for development of mushroom (Sousa et al., 2018). The definite proportion and availability of these elements within copious lignocellulosic materials extremely influence the enzymatic activities and metabolic pathways of Lentinulaedodes, consequently impacting mycelial growth and fruiting body development (Suwannarachet al., 2022)

Substantial variation in growth patterns, biological efficiency, and the nutritious character of the harvested mushrooms indicated in prior research that have extensively documented the diverse impact of various lignocellulosic materials on the cultivation parameters of Shiitake. Shanmugarajet al., 2024 signify that various substrates notably impacted Lentinulaedodesgrowth and yield. Lentil husks takes shortest period for spawn run and mycelial bump formation but produced fewer fruiting bodies whereas rice straw yielded the highest sporocarp count, followed by wheat straw.Supplementation of sawdust with wheat bran, rice bran, or maize powder similarly augments growth and yield parameters, emphases the importance of nutrient enrichment (Moonmoonet al., 2010). This continuously underscores how crucial is substrate enhancing for improving the yield and marketability in addition to optimizing economic yield.

Material and methods

The experiments were conducted in the Mushroom Unit, Department of Plant Pathology, School of Agricultural Sciences SGRR University, Dehradun India.

Preparation of Mother Spawn

Wheat grains as a substrate for spawn preparation. The grains were manually cleaned and were boiled for at least half an hour in tap water. The grains must not be ruptured or over boiled. After this the excess water is drained. Gypsum and chalk powder (1:3) were added to maintain ph and sticking of grains with each other. Followed by filling of prepared grains in polypropylene bags and sealing them with cotton plugs, the bags were autoclaved for two hours at 121ºc and 15 psi of pressure for sterilization. The bags were then left to cool for a full day. These bags were directly moved to the inoculation chamber. Soon after, the bags were inoculated with pure culture of Lentinula edodes-327 was from the Directorate of Mushroom Research, Solan. These bags were then maintained in an incubator at 25ºc until the grains were completely impregnated with the mycelium of the inoculated fungus culture (10–15 days).

Preparation of Different Substrates

Table 1: Substrate mixture used of Lentinulaedodes cultivation

Treatment	Substrates
T1.	Sawdust 1000gm + Wheat Straw 600gm + Wood Chips 300gm + Wheat Bran 100gm
T2.	Sawdust 1000gm + Rice Straw 600gm +Wood Chips 300gm + Wheat Bran 100gm
T3.	Sawdust 1000gm + Sorghum Straw 600gm + Wood Chips 300gm + Wheat Bran 100gm
T4.	Sawdust 1000gm + Finger-millet Straw 600gm + Wood Chips 300gm + Wheat Bran 100gm
T5.	Sawdust 500gm + Pearl-millet Straw 600gm + Wood Chips 300gm + Wheat Bran 100gm

Easily available agro-waste substrates were used for the experiments. The treatments were evaluated for growth and yield basis performance. The substrates were copped. The sawdust (teak), wood chips and their combinations were soaked for 12 hours separately. Next day wheat bran, 3 hours prior were soaked in clean water. The each combination was mixed with wheat bran + calcium carbonate () manually. The moisture content of the substrate mixture was maintained @ 60-65 %. The bags are then filled with substrates and autoclaved for 90 min under 22 psi. After that, Autoclaved bags were allowed to cool down at room temperature. The spawning is done in cooled bags @ 3% on wet substrates (120 gm per bag i.e. 4 kg in wet basis). The bags than transferred to cropping room with temperature ranging between 15-25ºc and humidity 70-90%.

Results and Discussion

The current experiment investigated the yield and growth performance of Lentinulaedodes grown under controlled conditions on various substrates. Mycelial run, bump formation, Browning, Stipe Diameter, Stipe length, Cap Diameter, Cap Thickness, Number of flushes, and biological efficiency were among the parameters that were examined.

Impact of different substrates on growth period of Lentinulaedodes

The data presented in Table 2, T1 had the shortest spawn run time (54.75 days) followed by T2 (60.75 days).The maximum spawn run period was taken by T5 (78.50 days). Similar results were examined by Shanmugarajet al., 2014 in which wheat straw shows favorable performance with durations ranging from 39.20 to 41.23 days. According

to Tarushiet al., 2020 Shiitake mushroom required 44 days to 60 days depending upon substrates for complete mycelial growth. Minimum time for bump formation was taken by T1 (32.50 days) while maximum time was taken by T4 (41.25 days) and T5 (38.00 days). The study also showed that T1 and T2 had the shortest browning period times, which were 8.50 and 10.75 days, respectively while T1 and T2 takes the minimum total incubation time (95.75 and 106.00 days, respectively).

Table 2: Impact of different substrates on growth period of Lentinula edodes-327

TREATMENT	SPAWN RUN(Days)	BUMP FORMATION (Days)	BROWNING (Days)	TOTAL INCUBATION PERIODS (Days)
T1	54.75	32.50	8.50	95.75
T2	60.75	34.50	10.75	106.00
T3	63.50	35.50	13.75	112.75
T4	67.50	41.25	13.25	122.00
T5	78.50	38.00	12.25	128.75
SE(d)	1.29	0.81	0.63	-
C.D	2.82	1.74	1.36	-

Average of four replications

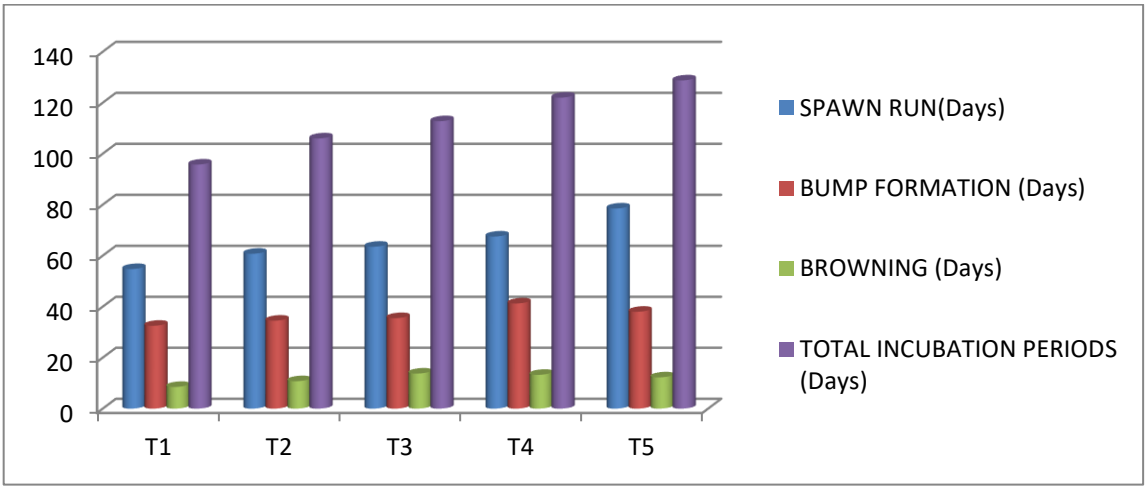

Fig 1: Growth of Lentinulaedodes on different Substrates

Impact of substrates on different growth stages of Lentinulaedodes

Table 3 summarizes the experiment's conclusion that T3 had the maximum stipe diameter (2.46 cm), followed by T1 (2.16 cm). T1 had the longest stipe (4.32 cm), T4 had the shortest (3.51 cm). T1 had the maximum cap diameter (8.24 cm), while T5 had the least (5.38 cm). T3 had the thickest cap, whereas T5 had the thinnest at 3.54 cm and 2.32 cm respectively. Abdullah et al., 2022 through their study revealed that substrate when

supplemented with Trifolium and molasses, produced a cap diameter of 6.7 cm and a stipe length of 6.0 cm. Ashrafuzzamanet al., 2009 reveled that cultivating Shiitake on jackfruit sawdust exhibited significantly higher growth parameters, including stalk length, stalk diameter, cap diameter, and cap thickness, compared to other substrates.

Table.3: Impact of substrates on different growth stages of Lentinula edodes-327

	STIPE DIAMETER (cm)	STIPE LENGTH (cm)	CAP DIAMETER (cm)	CAP THICKNESS (cm)
T1	2.16	4.32	8.24	3.54
T2	1.52	4.08	7.01	3.18
T3	2.46	3.63	6.85	3.29
T4	1.76	3.51	6.34	3.13
T5	1.41	4.23	5.38	2.32
SE(d)	0.18	0.08	0.17	0.14
C.D	0.40	0.18	0.49	0.31

Average of four replications

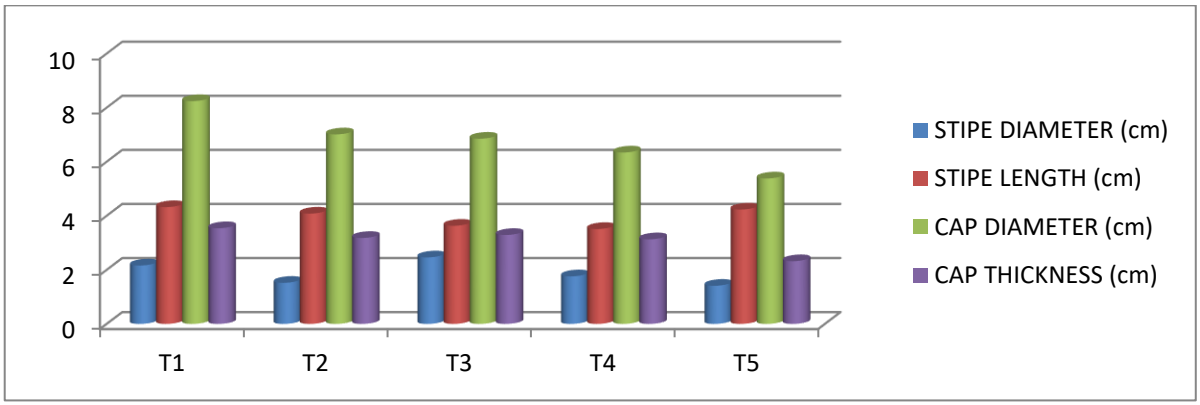

Fig 2: Growth parameters of Lentinulaedodes on different Substrates

Effect of different substrates on yield performance and biological efficiency of Lentinulaedodes

According to table 4, the results revealed that the highest yielding substrate in 1st flush was T3 (287.7 gm) followed by T1 (222.25 gm), while T5 produced the least amount (158.37 gm). T3 (175.23 gm) exhibits the best result in the case of the second flush yield, followed by T1 (132.80 gm). Once more, T3 displays the highest yield, 107.70 gm, while T4 displays the lowest yield, 56.75 gm in 3rd harvest. Biological Efficiency is maximum in T3 (28.54%) and least was recorded in T5 (16.01%). Similar results were examined by Avila et al., 2023 that wheat straw with 20% of wheat bran proved to be the most effective

substrate followed by wheat straw with 20% of rice bran for commercial cultivation of Lentinulaedodes. The study by Abdullah et al., 2022 found that for cultivating Lentinulaedodes, Phragmitesaustralis in fruiting stage, combined with Trifolium and molasses, yielded the best results in terms of growth and production parameters. Tranget al., 2023 studied that the cultivation of shiitake, mixture of 69% corncobs, 20% sawdust, 10% wheat bran, and 1% $CaCo_3$ led to a higher biological yield (36.5%). Shanmugarajet al., 2024 signify that various substrates notably impacted Lentinulaedodesgrowth and yield. Lentil husks takes shortest period for spawn run and mycelial bump formation but produced fewer fruiting bodies whereas rice straw yielded the highest sporocarp count, followed by wheat straw.

Table.4: Effect of different substrates on yield performance and biological efficiency of Lentinulaedodes

TREATMENT	1ST FLUSH (gm)	2ND FLUSH (gm)	3RD FLUSH (gm)	BIOLOGICAL YIELD (%)
T1	222.25	132.80	94.30	22.46
T2	204.60	121.40	62.25	19.41
T3	287.87	175.25	107.70	28.54
T4	196.10	119.67	46.75	18.12
T5	158.37	105.22	56.75	16.01
SE(d)	4.56	3.71	3.35	-
C.D	9.82	8.00	7.22	-

Average of four replications

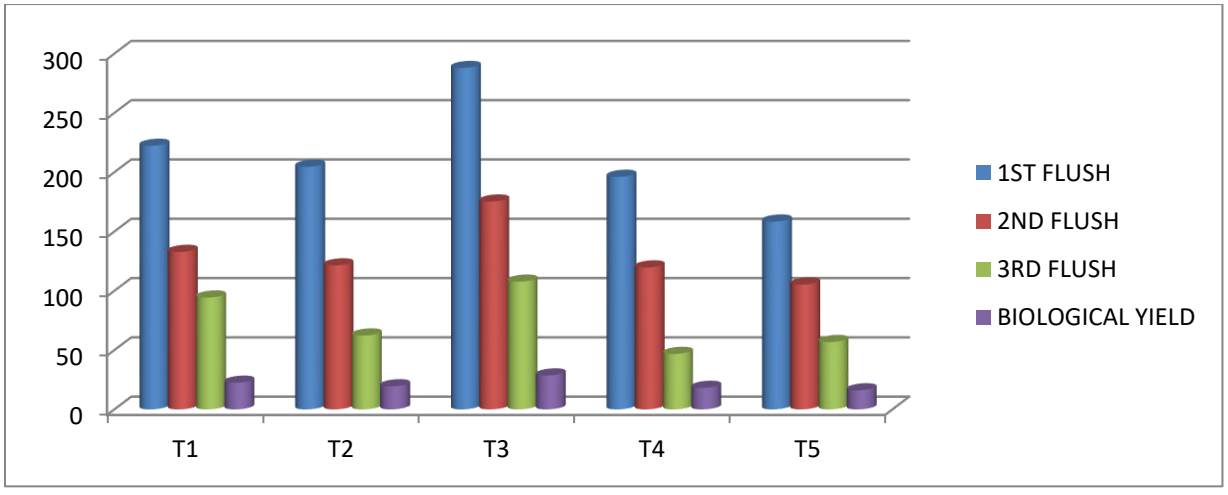

Fig 3: ffect of different substrates on yield performance and biological efficiency of Lentinulaedodes

		
1. Preparation of substrate	**2. Bags Inoculated with Lentinulaedodes spawn**	**3. Mycelium run**
		
4. Shock treatment	**5. Fruiting bag**	**6. Harvested mushroom**

Fig 4: Pictures showing the steps involved in Lentinulaedodes cultivation in T1

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