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Research Article

Comparative analysis of organic carbon, nitrogen, C: N value and composting performance of summer white mushroom (*Calocybe indica*) on different mushroom substrates wastes

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Abstract

The aim of this study was to determine the organic carbon, nitrogen, C: N content of the different mushroom substrates wastes of *Calocybe indica*, their mushroom substrate samples were collected at three different intervel and analyzed. The lower value of C (67.42%), higher value of N (1.78%) presents in ragi straw and best C: N value present in Casuarina dry leaves (35.00%) and bamboo dry leaves (32.65%). These two produce good quality of compost and this study suggests using these agricultural wastes to make good income and eco friendly nature.

Keywords: Carbon, Nitrogen, ragi straw, Casuarina dry leaves, bamboo dry leaves.

Introduction

In India, basically 70 per cent of peoples from agriculture land mostly suffer due to the climatic changes during summer and winter and monsoons which causing major role in affecting agriculture products. A huge amount of waste was generated by the agricultural sector, forest exploitation and food industries, which are chemically treated or sent to sanitary landfills. In India, Tamilnadu shares 25% of the total production in the country (Tewari, 2003). At present, it was estimated to be about 50,000 tonnes productivity. In the production of specialty mushrooms like *Calocybe indica* pose serious challenge to the current supremacy of button mushroom in the world market (Miller, 1994) and substrate waste disposal. In the search for equilibrium between the social, economic and environmental factors, the reuse of agricultural waste has taken on an extremely important dual purpose: elimination of the waste from the environment and giving it added value through the production of low cost food not only save environment but also fetch income to agriculturists.

Materials and Methods

The potentials of various locally available substrates were explored to select the best supporter for the production of *Calocybe indica.* The substrates used for the experiment were as follows: paddy straw,

ragi straw, blackgram empty pod, greengram empty pod, bamboo dry leaves and casuarina dry leaves.

Sampling of substrates

A composite sample of 100 g was collected from different bags of both mushroom at regular intervals, before spawning, at the time of casing (after complete mycelial colonization) and final harvest. The samples were kept in hot air oven at 60°C to a constant weight. The dried material was powdered and samples were stored in polythene bags. The samples were used for various estimations in order to analyze nutrient status of the substrates.

Chemical analysis of samples

Dry matter estimation

10 gram of sample was dried at 105°C to reach a constant weight for 8 - 12 hours and the weight loss was expressed as moisture % from which dry matter % was estimated.

Total nitrogen (mg/g)

Total nitrogen was determined by Kjeldahl method as outlined by Bremmner (1979). 0.5 g of sample was digested with concentrated sulphuric acid approximately 250 mg of catalyst mixture containing potassium sulphate : copper sulphate : selenium in the ratio of 100:20:1 until clearing of the sample took place. The digested sample was diluted with distilled water and addition of sufficient quantity of 40 per cent NaOH to make the digest alkaline. The evolved ammonia was absorbed in 25 ml of 4 per cent boric acid and titrated with 0.05 N sulphuric acid using mixed indicator. The quantity of nitrogen in the sample was calculated as follows.

$$\text{Percent nitrogen} = \frac{\text{Titre value x N of } H_2SO_4 \text{ x } 14}{\text{Volume of the sample}} \text{ x } 100$$

Organic carbon (%)

Organic carbon content of the sample was determined by Walkley and Black Wet oxidation method as described by Jackson (1973). To the residue obtained by drying 25 g of sample, ten ml of potassium dichromate solution was added along with 20 ml of concentrated sulphuric acid. The excess of chromic acid was titrated against 0.5 N ferrous ammonium sulphate until the last traces of blue colour disappears. A blank was also run without the sample percentage of organic carbon was obtained using the following formula.

$$\text{Organic carbon (\%)} = \frac{\text{Blank titre x N of ferrous Ammonium sulphate x 0.003 x 100}}{\text{Volume of the sample}}$$

Results and Discussion

Changes in the organic carbon content of substrates at different growth stages of *Calocybe indica*

However, mycelial growth of *Calocybe indica* was repressed by all inorganic nitrogen compounds tested, but yeast extract and histidine nurtured the mycelium among all organic nitrogen source used (Chandra and Purkayastha, 1977).

The analysis of mushroom growth was tested on ragi straw, blackgram empty pod, greengram empty pod, bamboo dry leaves, casuarina dry leaves and paddy straw. The data recorded on the organic carbon content of these substrates at different intervals due to inoculation of *Calocybe indica* was presented in Table. 1. The carbon content was high in an initial stage and then gradually decreased in casing stage and at final harvest. The substrates inoculated with *Calocybe indica* had positive influences on the organic carbon content. In general, the organic carbon content of substrates was found to be decreased significantly with increase in the intervals upto final harvest stage, but it differed significantly on initial, casing and final. Among the substrates, greengram empty pod (GGP) recorded lower organic carbon content (at initial 80.60 %, at casing 77.18% and at final 75.28%) followed by blackgram empty pod (BGP) (at initial 81.43%, at casing 80.27% and at final 78.95%), ragi straw (RS) (at initial 86.62%, at casing 82.39% and at final 67.42%), paddy straw (PS) (at initial 91.78%, at casing 86.37% and at final 75.42%),

bamboo dry leaves (at initial 92.53%, at casing 89.85% and at final 81.90%) and higher organic carbon content recorded on casuarina dry leaves (at initial 94.50%, at casing 91.85% and at final 82.50%) at primary level selection of substrates.

Changes in the organic carbon content of substrates at different growth stages of *Calocybe indica*

The substrates inoculated with *Calocybe indica* had positive influences on the organic nitrogen content. In general, the organic nitrogen content of substrates was found to be decreased significantly with increase in the intervals upto final harvest stage, but it differed significantly on initial, casing and final. The data recorded on the organic nitrogen content of these substrates at different intervals due to inoculation of *Calocybe indica* was presented in Table. 2.

Among the substrates, greengram empty pod (GGP) recorded lower organic nitrogen content (at initial 1.04%, at casing 1.18% and at final 1.06%) followed by blackgram empty pod (BGP) (at initial 1.19%, at casing 1.35% and at final 1.22%), paddy straw (PS) (at initial 1.20%, at casing 1.75% and at final 1.70%), ragi straw (RS) (at initial 1.24%, at casing 1.90% and at final 1.70%), bamboo dry leaves (at initial 1.94%, at casing 1.76% and at final 1.50%) and higher organic nitrogen content recorded on casuarina dry leaves (at initial 1.98%, at casing 1.85% and at final 1.72%) at primary level selection of substrates.

Chakravarthy *et al*., (1981) cultivated *Calocybe indica* on paddy straw compost supplementary with inorganic substance like nitrogen, phosphorus, potassium which gave maximum milky mushroom yield when compared to paddy straw compost alone.

Changes in the C:N ratio of substrates at different growth stages of *Calocybe indica*

The mushroom growth was tested on ragi straw, blackgram empty pod, greengram empty pod, bamboo dry leaves, casuarina dry leaves and paddy straw. The C:N ratio of these substrates at different intervals due to inoculation of *Calocybe indica* was presented in Table - 3. The C: N ratio was high in an initial stage and then gradually decreased in casing stage and at final harvest.

The C: N ratio of substrates was found to be decreased significantly with increase in the intervals upto final harvest stage, but it differed significantly on initial, casing and final. Among the substrates, bamboo dry leaves showed best C:N ratio (at initial 47.70, at casing 43.05 and at final 32.65) followed by casuarina dry leaves (at initial 43.00, at casing 40.00 and at final 35.00), paddy straw (PS) (at initial 72.18, at casing 45.00 and at final 38.50), ragi straw (RS) (at initial 74.00, at casing 47.00 and at final 44.05), greengram empty pod (GGP) (at initial 68.35, at casing 55.40 and at final 48.50) and blackgram empty pod (BGP) (at initial 68.45, at casing 57.00 and at final 50.75).

The substrates inoculated with Calocybe indica had positive influences on the organic carbon content. Among the substrates, greengram empty pod recorded lower organic carbon content followed by greengram empty pod, ragi straw, paddy straw, bamboo dry leaves and higher organic carbon content recorded on casuarina dry leaves at primary level selection of substrates. Among the substrates, greengram empty pod recorded lower organic nitrogen content followed by greengram empty pod, paddy straw, ragi straw, bamboo dry leaves and higher organic nitrogen content recorded on casuarina dry leaves. The substrates inoculated with *Calocybe indica* had positive influences on the C:N ratio.

Among the substrates, bamboo dry leaves showed least C: N ratio followed by casuarina dry leaves, paddy straw, ragi straw, greengram empty pod and black gram empty pod.Similar trend has been reported by Ramalakshmi (1996). Easily be transformed into a wide diversity of products (edible or medicinal food, feed and fertilizers), protecting and regenerating the environment (Bano and Rajarathnam, 1982).

Table1. Organic carbon content (%) in various substrates at different stages of growth on *Calocybe indica*

Substrate	Intervals		
	At initial (%)	At casing (%)	At final harvesting (%)
Paddy straw(PS)	91.78	86.37	78.40
Ragi straw(RS)	86.62	82.39	67.42
Blackgram empty pod(BGP)	81.43	80.27	78.95
Greengram empty pod(GGP)	80.60	77.18	75.28
Bamboo dry leaves	92.53	89.85	81.90
Casuarina dry leaves	94.50	91.85	82.50
SE_D	2.42	2.32	2.26
CD (P=0.05)	6.24	5.97	5.81

Table 2. Organic nitrogen (%) in different substrates at different growth stages of *Calocybe indica*

Substrate	Intervals		
	At initial (%)	At casing (%)	At final harvesting (%)
Ragi straw(PS)	1.24	1.90	1.78
Paddy straw(PS)	1.20	1.75	1.70
Blackgram empty pod(BGP)	1.19	1.35	1.22
Greengram empty pod(GGP)	1.04	1.18	1.06
Bamboo dry leaves	1.94	1.36	1.29
Casuarina dry leaves	1.98	1.47	1.32
SED	0.16	0.11	0.11
CD (P=0.05)	0.43	0.28	0.29

Table 3. C:N ratio of various substrates at different growth stages of *Calocybe indica*

Substrate	Intervals		
	At initial	At casing	At final harvesting
Ragi straw(RS)	74.00	47.45	44.05
Paddy straw(PS)	72.18	45.00	38.50
Blackgram empty pod(BGP)	68.45	57.00	50.75
Greengram empty pod(GGP)	68.35	55.40	48.50
Bamboo dry leaves	47.70	43.05	32.65
Casuarina dry leaves	43.00	40.00	35.00
SED	5.46	2.79	3.00
CD (P=0.05)	14.03	7.17	7.72

Conclusions

The organic carbon, nitrogen content nad C: N ratio of the substrates at different intervals of *Calocybe indica* mushroom substrate was studied. The organic carbon, nitrogen content and C: N content was high in the initial stage and then gradually decreased in casing stage and at final harvest. The best C: N value present in Casuarina dry leaves (35.00%) and bamboo dry leaves (32.65%). These two produce good quality of compost and this study suggests using these agricultural wastes to make good income and eco friendly nature.

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