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Cultivation of milky white mushroom (*Calocybe indica*) from agricultural waste paddy straw

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Abstract
476 gm of mushrooms were produced from 1kg of paddy straw and 100 gm of spawn, in approximately 52 days. Thus produced mushrooms were analyzed for the macro and micro nutrients (mineral) by taking 100 gm of fresh weight for macro nutrients and dry weight for mineral analysis. High quantity of carbohydrates (6.88 gm %), moderate quantity of protein (1.63gm %), and negligible amount of Lipids (0.22gm %) were found. All these quantities are approximately nearer standard *Calocybe indica.* Moisture content of fruit body was high enough that is 82.6. Among the studied minerals, phosphorus was found to be high enough (63.6mg/g). The next mineral was calcium that is 4.67mg/g. Among the four studied minerals iron was present in least quantity that is 1.57mg/g.

Keywords: Agricultural waste, mushroom cultivation, macro nutrients, minerals

Introduction
The major climatic zone of India is sub-tropical which supports varied food crops. The different food crops comprise cereals, pulses, millets, vegetables, fruits, flowers, medicinal plants, spices, mushrooms etc. As the population increased, there was a necessity for more agricultural produce [1-3]. With the benefit of Green revolution, there was a possibility of getting three crops in the year. Due to necessity of more produce, as there was no time for the natural mineralization (plant debris remained after harvest) to happen, so organic waste quantity is increasing day by day. Part of Agricultural waste is used as fodder to cattle rest of it was unused (Management of plant debris became a major issue). In later days management of Agro waste became big problem [4], recent study reveals that India is producing 960 million tons (MT) of solid waste annually out of these 350 million tones are organic wastes from agricultural sources. Rest of them is from different sectors like industrial, mining, commercial and natural hazards etc. Recent trends in solid waste management resulted in new applications of waste, by making the solid waste into (Excluding the 350 million tonesof agro waste) bricks, blocks, tiles, aggregates, cement and lime etc. whereas agro waste major percent is incinerated, which creates pollution [5]. To safeguard the environment, efforts are being made for the bio conversion of the agro waste will be the value added application [6]. Agriculture waste is rich in various types of nutrients like Lingocellulosic components which are complex and very difficult for the biodegradation [7, 8]. Biodegradability of Lingocellulosic material vested in only few basideomycetes. Among them few edible mushrooms are there which can grow in this agro waste. Various edible mushroom strains were cultivated worldwide on different agro waste material [9]. More than 2000 years ago people used to consume wild edible mushrooms as a source of food and also as medicines. This lead the way to commercial cultivation of edible fungi. In recent days income from agriculture is becoming uncertain, due to though there is a production of good quality and quantity of the produce due to unseasonal rains, adverse climatic conditions, fluctuations in marketing strategies etc. Present study aims to address the two issues like value added utilization of agro waste as part of solid waste management in eco-friendly manner and generating additional income to the farmer without spending extra investment.

Materials and methods
1 kg of paddy straw is taken, chopped into 4-5cm peaces then soaked in clean water for 6 hours. Care must be taken to maintain 50-55% of the moisture content with the chopped straw after sterilization at 15 lbs for 10 min. Sterilized straw is packed in the polythene cover, at regular strata spawn was introduced in a aseptically to the bag. Finally the polythene bag was closed with rubber band. Few holes were made so as to maintain gaseous exchange. Such bags were kept in a small room, where there is a no possibility of contamination. When mycelium spreads throughout the bag then it has to be transferred into sterilized casing bed which is

made with coconut fiber powder and red soil. Regularly to retain the moisture content water is sprinkled on to the bed. Then after 14-15 days the pin head bodies were developed. Quantitative analysis carried of carbohydrate (Anthrone method), Protein (Lowry's method) and Lipids (Isolation and purification). Minerals were determined in dried milky white mushroom *(Calocybe indica)* sample by standard operational procedure (APHA 2012).

Results and discussion

Table 1: Progress of the milky white mushroom *(Calocybe indica)* cultivation

S.no	Days	Findings
1	Day 1	Polythene bag were packed with paddy straw and Spawn
2	Day 2	Appearance of mycelium observed in the polythene bag
3	Day 7	Initiation of mycelium growth was observed in entire polythene bag
4	Day 14	Thin layer of mycelium was observed in entire polythene bag
5	Day 21	Complete formation of thick mycelia mat all around the bed
6	Day 22	Beds were transferred casing after 21 days
7	Day 36	Pinhead of growth was seen after 14 days from casing bed
8	Day 40	Appearance of pin heads all over the casing
9	Day 45	Pin head mushrooms grown up to 2cm
10	Day 47	Majority of the mushroom could grow up to 4.7cm
11	Day 51	Majority of the fruit bodies grown up to 7.2 cm

Fig 1: Rising of bags

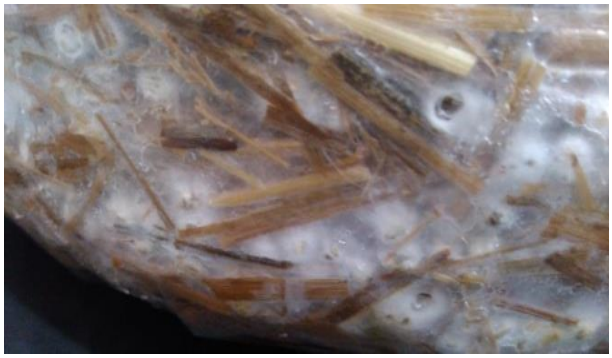

Fig 2: Initial growth of mycelium in 7 days

Fig 3: Formation of mycelium in 14 days.

Fig 4: Complete formation of mycelium in 21 days

Fig 5: Bag taken for casing after 21 days.

Fig 6: Pin head stage after 14 days from casing

Fig 7: Pin head stage growth of mushroom

Fig 8: Mushroom ready for harvesting

From the table1 and figure (1-8) it was observed that after inoculating spawn in to the polythene bag after a day means on 2nd day appearance mycelia growth was observed from 2 or 3 seedling. By the 7th day initiation of mycelium growth was observed in entire polythene bag. By the 14th day thin layer of mycelium was observed in entire polythene bag. By 22nd day beds were transferred to casing. After 14 days of casing pin heads of mushrooms were seen. After four more days the casing was with complete pin head growth. By 51 days the fruit bodies could grow up to 7.2cm further growth was not observed. Then by 55 days fruit bodies were harvested and proceed for biochemical analysis of fruit body. From 1kg of paddy straw, 100 gm of spawn nearly 476 gm of fruit body were produced without adding any extra chemical except water. After harvesting again it can be maintained to get another crop.

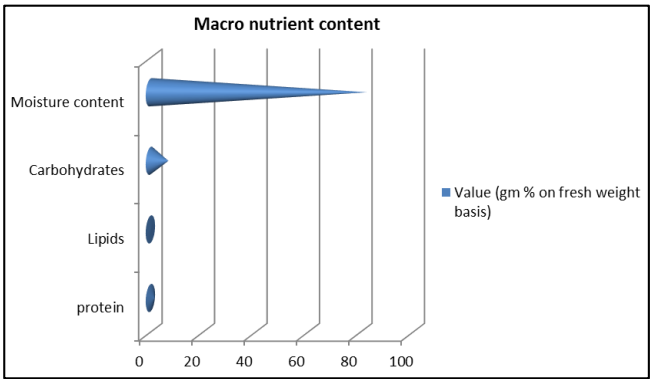

Chart 1: Macro nutrient content of milky white mushroom (*Calocybe indica*)

From the Chart 1 it was observed that protein content was 1.63 gm/100gm of fresh weight. Lipid quantity was quantified as 0.22gm/100gm of fresh weight. Carbohydrates are present in good quantity that is 6.88gm/100gm of fresh weight. 82.56gm percentage of moisture content was present of fresh fruit body.

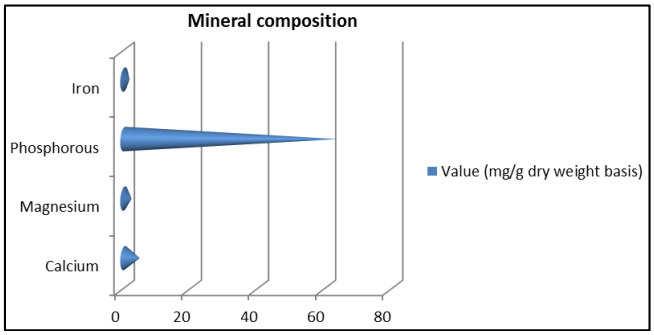

Chart 2: Mineral composition of milky white mushroom *(Calocybe indica)*

From the harvested fruit body mineral composition was analyzed and presented in Chart 2 it was evident that among the four different analyzed mineral phosphorous was present in high quantity that is 63.6mg/g dry weight. And iron was present in meager quantity that is 1.57 mg/g dry weight. Calcium was founded in moderate quantity that is 4.67 mg/g dry weight.

Discussion

Similar to our present study different agricultural waste like weed, paddy, molasses, banana leaves, tea leaves, saw dust etc were used to cultivate different species of edible mushrooms [10-12]. When soya bean straw alliances with weed straw used to grow *Plueurotus sajorgaju* and founded that 87.3 biological efficiency when saw dust was used along with ride husk *P. ostreatus* could show optional growth [13]. Mushrooms are alternate food for human beings starting from human civilization, because it is rich in protein, non-starchy carbohydrate, fiber, different minerals, vitamins, negligible amount of fat and no cholesterol [14]. The mushroom plueurotus genes are very sensitive and delicate. They start spoiling within 1 day of harvesting [15]. Crude protein, crude fat and carbohydrate content were studied on plurotus species on different dried methods to increase the shelf like period of mushroom. Crude protein and fat was good in sun ride. Carbohydrate content was maximum in oven ride [16]. Mushrooms are good source of protein, minerals (phosphorus, calcium, iron, potassium, sodium) and vitamins like thionine, riboclavin, folic acid and niacin. They are also medicinally valuable for diabetes. They are good in cancer therapy. They also contain a wide variety of metabolites like anti-tumor, anti genotoxic, anti-accident, anti-hyper sensitive, anti-platelet aggregating anti glycianic, anti-microbial and anti-viral activity [17].

Conclusion

From the study it was concluded that paddy cultivating former can adopt this techniques of cultivating milky white mushroom *(Calocybe indica)* without spending extra investment. With this method management of agricultural waste through bioconversion method will be achieved and it can be a boom for agricultural solid waste management. From 1 kg of paddy straw 476 gm of product was produced, worth of Rs 170 /-kg,a this can be additional income to the former.

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