# Boosting of Agricultural and Forest Waste through *Pleurotus* Mushroom

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**Abstract :**
*Pleurotus* mushroom cultivation is economically viable technique through solid state fermentation. After cultivation of two *Pleurotus* varieties *viz. P. sapidus* and *P. flabellatus* on five substrates *viz.* Soybean straw (S), Sugarcane Bagasse (SB), Rice Bran (RB), Forest Waste (FW) and their combination in equal proportion, the SMS was collected and biochemically analyzed. The control substrates were also analyzed. In comparison to plain forest waste and agrowaste the SMS of both varieties were reported to contain higher crude protein, lower crude fibre values. Slight changes in mineral contents *viz.* Na, K, Ca were recorded with increase in Na and Ca contents and slight decrease in K content. Thus in conclusion, it is stated that the SMS is biochemically rich compared to agrowaste and can be supplemented with agricultural waste as better economical animal feed with lower use of food grains to control food shortage. This can be a better way for controlling environmental pollution and disposal of waste.

**Key words:** *Pleurotus*, Mushroom, Substrate, Animal feed.

**Introduction :**
The food problem in India is increasing day by day. Crop residues are used as animal feed. Due to recalcitrant lignin and its physical seal around cellulose and hemicellulose, it is of low feeding value (Zelenak, 1990). The lack of land fill space is continuing problem (Ince, 1994). Burning of agricultural waste causes global warming. Typically most of the agricultural biomass is comprised of about 10% to 25% lignin, 20% to 30% hemicellulose and 40% to 50% cellulose (Iqbal *et al.*, 2013). Mushrooms have the ability to degrade lignin along with cellulose and hemicellulose. Of the three components, lignin is the most recalcitrant to degradation whereas cellulose, because of its highly ordered crystalline structure is more resistant to hydrolysis than hemicellulose (Howard *et al.*, 2003). The cultivation of edible mushroom offers one of the most feasible and economic method for bioconversion of lignocellulosic wastes (Patil, 2012). In the last thirty years total mushroom production on worldwide has increased more than 6 folds i.e. from about 1.2 million metric tons in 1980 to about 7.3 million metric tons in 2010 (Sendi *et al.*, 2013). Disposal of SMS is a great concern due to less storage area than demand and can be solved by aspiring new utility for SMS (Romaine and Holcomb, 2002). This study was conducted to determine whether the *Pleurotus* mushrooms have potential to increase the feeding values particularly proteins, lowering crude fibers and improving the minerals of spent mushroom substrate compared with agricultural and forest waste.

**Materials and Method :**

**1) Spent mushroom straw preparation :**
The spawns of two varieties of *Pleurotus* mushroom *viz. Pleurotus sapidus* and *Pleurotus flabellatus* were obtained from Agriculture College, Pune. The different agrowastes *viz.* Soyabean straw, Sugarcane bagasse, Rice bran, Forest waste were collected locally from farms and forest. The substrate straw and beds were prepared according to procedure described by Bano and Nagarajan (1976). The spent mushroom substrate (SMS) was collected after each flush. It was sun dried and oven dried for further estimations.

**2) Estimation of crude fibre:**
Crude fibre contents in SMS were estimated according to Maynard (1970).

**3) Estimation of proteins :**
Protein contents in SMS was measured by Bradford method (Bradford, 1976).

**4) Estimation of minerals (Na , K, Ca) :**
Estimation of sodium, potassium and calcium was done by flame photometric method (Kapur and Govil, 2000).

**Results and Discussions :**

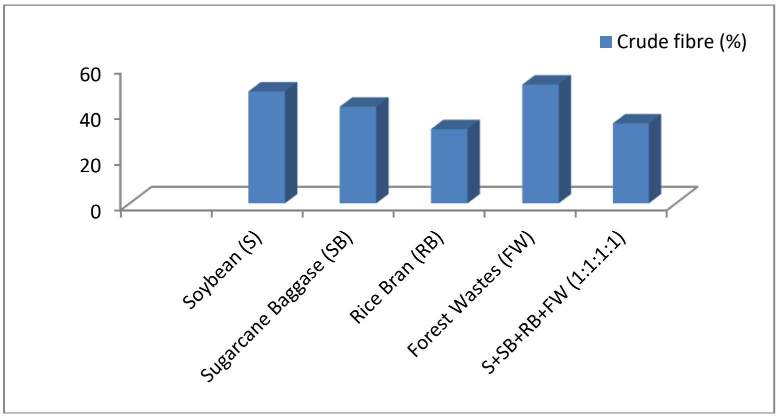


**Fig. 1(A) : Biochemical analysis of control substrate**

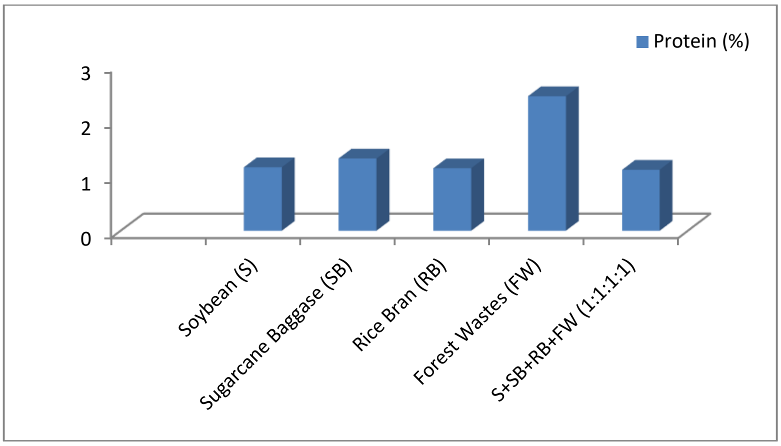


**Fig. 1(B) : Biochemical analysis of control substrate**

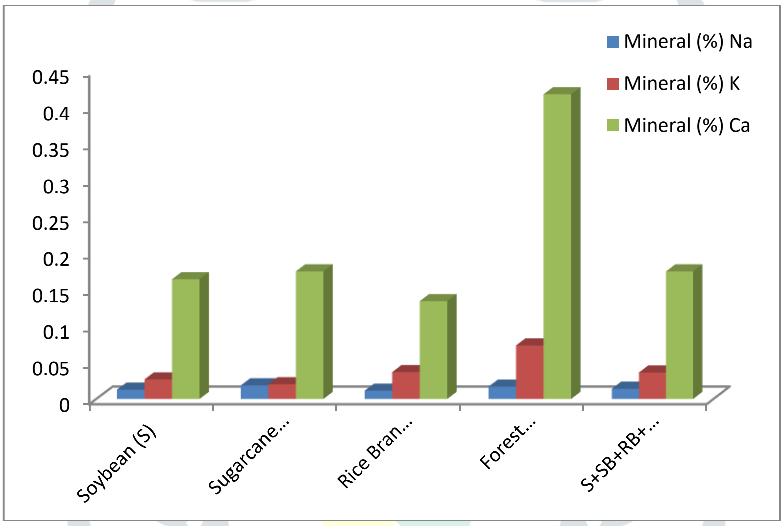


**Fig. 1(C) : Biochemical analysis of control substrate**

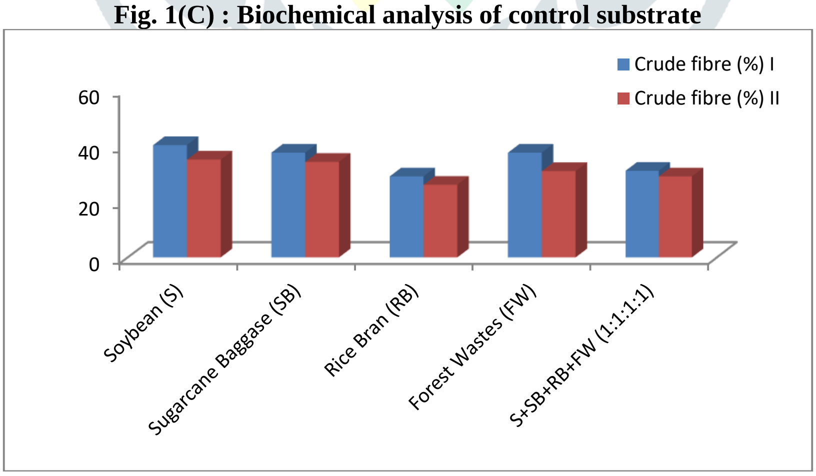


**Fig. 2(A) : Biochemical analysis of *P. sapidus* SMS**

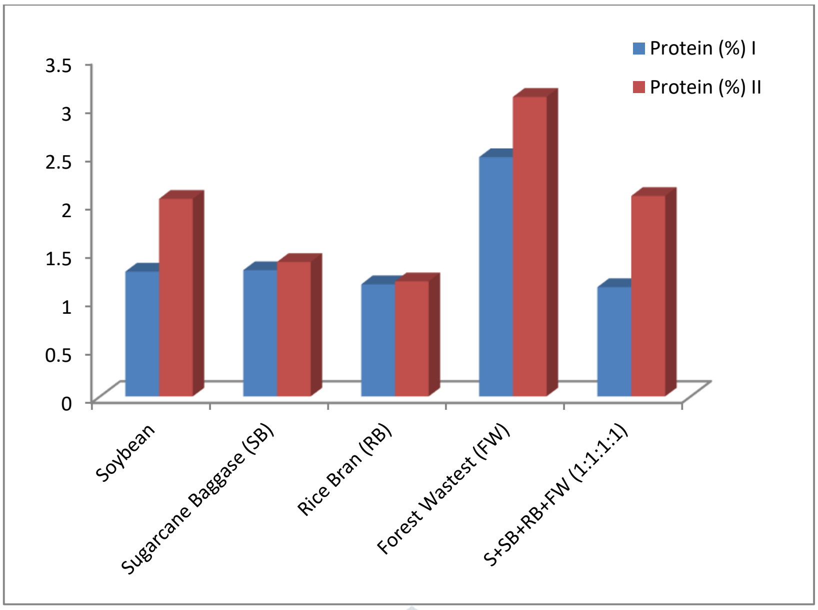


**Fig. 2(B) : Biochemical analysis of *P. sapidus* SMS**

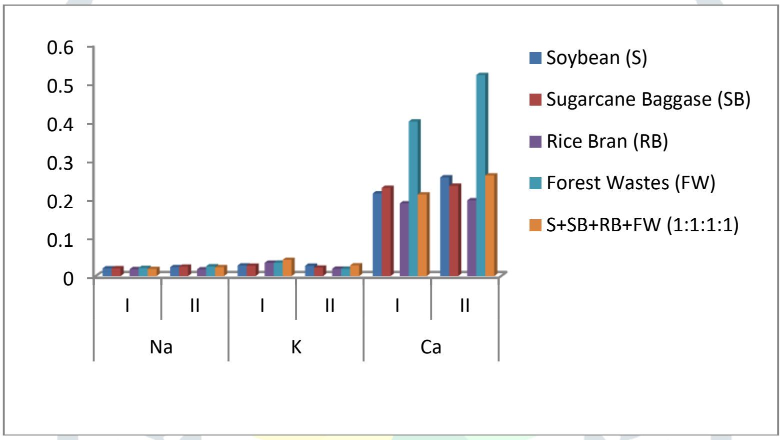


**Fig. 2(C) : Biochemical analysis of *P. sapidus* SMS**

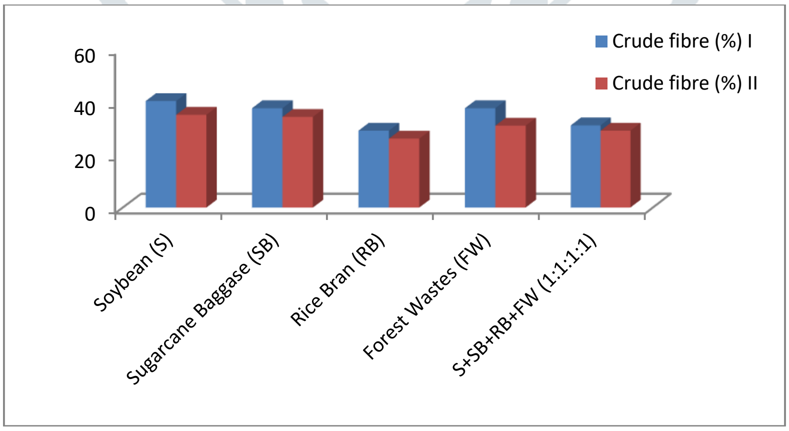


**Fig. 3(A) : Biochemical analysis of *P. flabellatus* SMS**

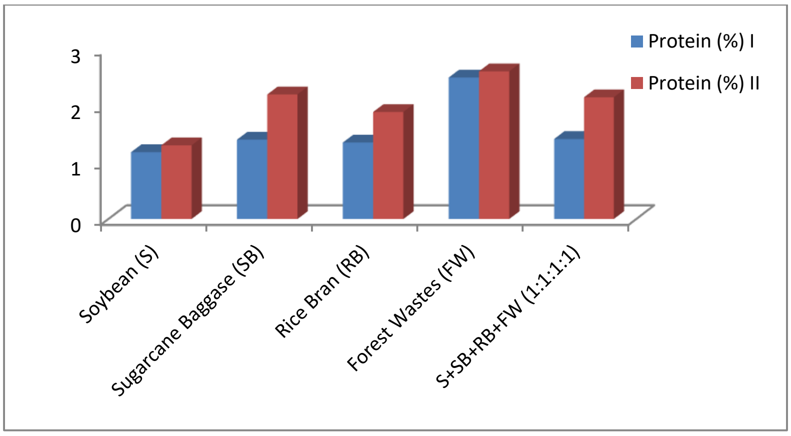


**Fig. 3(B) : Biochemical analysis of *P. flabellatus* SMS**

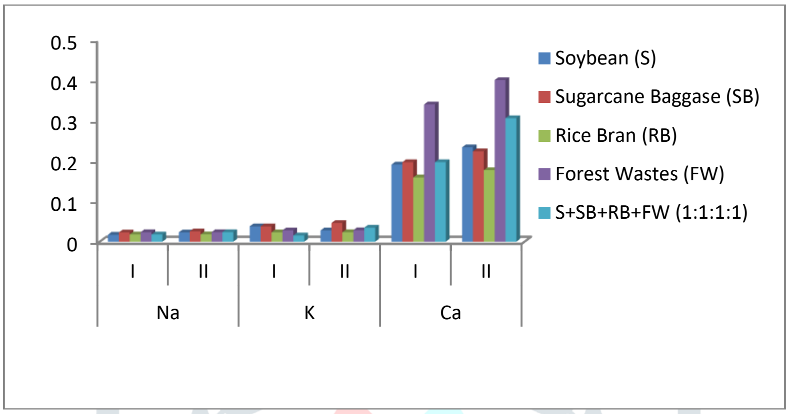


**Fig. 3(C) : Biochemical analysis of *P. flabellatus* SMS**

It was observed that the maximum decrease in crude fibre (%), the maximum increase in protein content (%) in SMS of *P. sapidus* and *P. flabellatus* were recorded as [42.5% (FW), 46.63% (S+SB+RB+FW)], [40.57% (FW), 48.37% (S+SB+RB+FW)] respectively. The range of increase in protein content is [5.25% to 46.63% (*P. sapidus*); 6.51% to 48.37% (*P. flabellatus*)] and extent of decrease is crude fibre content is [6.15% to 42.5% (*P. sapidus*); 17.14% to 40.57% (*P. flabellatus*)].

The extra cellular ligninolytic enzymes secreted by *Pleurotus* species may be responsible for reduction in cell wall components and also increase in protein contents as well as diminuition in crude fibre contents in SMS.

The present study reveals the augmention in minerals contents *viz*. Na, Ca, whereas slight decrease in K contents is observed.

According to Patil *et al.* (2010), *P. ostreatus* spent straw *viz.* soybean straw, wheat straw and their combinations presented similar results to our study as an increase in crude protein content (4.9% to 9.9%) decrease in crude fibre content (16.20% to 22.07%). Kut Lu *et al.* (2000) recorded the increase in crude protein content by 60% on wheat straw and 16% decrease in crude fibre content by inoculating with *P. florida*. The results are comparable to our study. Jafri *et al.* (2007) reported higher value of increased CP content of *Pleurotus* varieties (5.22 to 6.75g /10g) on rice straw. As compared to plain agrowastes slight differences in Na, K and Ca contents are observed. Only a slight increase in Na, Ca and decrease K contents is seen in both the SMS varieties. The mean values of spent *Agaricus* mushroom from Pensylvania for Na, K, Ca contents were 0.11%, 1.04%, 2.32% respectively (Fidanza *et al.*, 2010). The values are higher as compared to our study.

Marwaha *et al.* (1990) reported that in vitro DM digestibility of wheat straw fermented with *P. sajor-caju* have higher concentration of CP. The *P. ostreatus* SMC had not only increased crude protein (upto 16.34%),but it was also enriched in vitamins, amino acid, celluloses and used as feedstuff for animals such as beef, rabbits and pigs (Juan, 2000). *Shiitake* SMC along with cow manure, banana stems were used as food material to raise number of earthworms. A total of 1388 earthworms were produced from 50 earthworms (Zhuo, 2003). Li Hao-Bo reported feeding different percentage (20%, 25%, 30%) of waste material from *Lentinus edodes* and *Pleurotus ostreatus* (WMLE) and normal diet to non pregnant sows, pregnant sows and sickling sows. Living piglets number average weight of new born piglet, lactation ability of sows are all improved. Piglet mortality and diarrhea decreased (Li Hao-Bo, 2005). The fish feed stuff 3:7 of SMC and barley powder respectively increased fish production 35.91% and reduced feed cost 23.7% compared with that of feeding barley powder alone (Oei Peter, 2007).

**Conclusion :**

The present study concludes that both the *Pleurotus* varieties have ability to improve the nutritive value of agricultural wastes as SMS. The most valuable SMS can be used as a supplement to agricultural waste due to high CP, less crude fibre and mineral contents. Thus, can be economically able for reducing the use of food grains and the best solution for controlling environmental pollution.

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