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Management of Agricultural Waste into Protein Rich Substrate by *Pleurotus Sajor Caju* (Fr.) Singer

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Abstract
Mushroom cultivation is a profitable side business and no land is required. Within the one month fruiting bodies harvested. These are the cheapest source of protein, fibers, minerals, vitamins and very less amount of sugar and lipids (Bilal and Wani, 2010). After the harvesting the field crop plant debris may be used for the mushroom cultivation (Reddy, 2019). Cultivation technique is easy and simple everyone can do it. Mushroom cultivation carried out in any season throughout the year. Each cycle can be completed 40 to 45 days and no sun light is required. Mushroom cultivation in the dark, moist, suitable temperature and other controlled condition need to be maintained in houses, laboratories and any other places. Agro waste material after the harvesting from the field may be utilized for cultivation of different types of mushroom. Commonly Mushrooms are cultivation on rice straw, wheat straw, maize straw, sorghum straw, pulses and many other harvested crops (Dundar *et al*, 2009). In the present study different agriculture wastes were used as a substrate for the cultivation of Oyster mushrooms. Agro wastes were used singly or combinely for the commercial cultivation of oyster mushroom (Sangwan and Saini, 1995). *Pleurotus sajor caju* (Fr.) Singer pink variety was used for further studies. Firstly oyster mushroom cultivated on single substrate and later on combine substrate effect on the yield of *Pleurotus* mushroom was studied (Shymal Rajak *et al*, 2011). Yield trials were carried out and high yielding substrates were used further experiment. Growing demand of nutritious mushrooms is increased every year in the world. Preparation of bed, mycelial development and fruiting body yield in the form of number, size and fresh weight was determined (Shukla, 2011). Fruiting bodies are non-conventional food source.

Keywords: *Pleurotus sajor caju*, Spawn, different substrates, Protein, fruiting bodies, etc.

Introduction

Mushroom growing initiated in the 17th century and today more than 60 species of mushrooms have been cultivated globally. *Pleurotus sajor caju* are cultivated by using different agro wastes as substrates for the cultivation. Mushroom farming in India is becoming more popular and successful. Economy of farmer and empowerment of women is possible by this side business. In India paddy and wheat straw are commonly used for the commercial production of oyster mushroom (Jain and Vyas, 2002). A wide range of lignocellulosic agricultural waste used for cultivation of oyster mushroom. Paddy straw was the best substrate for cultivation of oyster mushroom (Bano and Shrivastava, 1962). Similarly next to paddy straw, wheat straw proved to be best for cultivation of *Pleurotus sajor caju* (Bonatti *et al*, 2004) Along with these substrates sorghum straw, rye, banana, maize straw were used by different researchers (Madan *et al*, 1987). A large part of population of country living under below poverty line and wide spread malnutrition particularly in children and women found to be a bigger nutritional problem. *Pleurotus* was cultivated on different substrates viz. Wheat straw, Paddy straw, Soybean straw, Pigeon pea, Green gram straw and Corn cob (Bonatti *et al*, 2004). In the present study cultivation of oyster mushroom on the different agricultural substrates singly and in combined 1:1 proportion was used. Appropriate size different substrate beds were prepared by inoculating the oyster mushroom spawn. After the incubation development of mycelium and later on fruiting bodies were formed. Fresh weights of fruiting body were measured. Protein content was determined separately

(Patrabansh & Madan, 1997, Patil S. S. *et al*, 2010). The highest protein percentage was found when it cultivated on wheat + pigeon pea substrate. Protein constituent of oyster mushroom were determined (AOAC, 1975). Similar study was carried out by Sueli Olivera Silva *et al* (2002). Large amount of agro waste available in India which is burn outside the field leads to air pollution as in Punjab state. If this rice and wheat straw were utilized for the cultivation of different types of mushrooms economy of farmer improved. Hence this study was undertaken.

Materials and Methods

Source of Spawn

The spawn of pink variety oyster mushroom (*Pleurotus sajor caju*) obtained from NCL, Pune and mushroom research centre, Agriculture College, Pune, India.

Collection of Different Agricultural Substrates

After harvesting of crops, the plant debris commonly burnt in the field causes pollution. These agricultural wastes were used in for cultivation of *Pleurotus sajor caju*. Rice, Wheat, Soybean, Pigeon pea and Green gram debris were collected from different fields and brought into laboratory separately in gunny bags (Reddy, 2019).

Cutting and Sterilization

Dried agro wastes were chopped separately into 2-4 cm long and soaked in water overnight, excess of water drained off and dipping into the hot water at 80^0C for one hour. Straw become smooth and sterilized which suitable for the growth of oyster mushroom.

Spawn Multiplication

Wheat grains were boiled in water bath for 20 min and mixed with 4% CaCO3 and 2% CaSO4. These grains were inoculated with pure strain of *Pleurotus sajor caju* for mycelial growth. After incubation whole grains were covered by white mycelial threads. Required amount of spawn were prepared and stored carefully. This spawn stored in refrigerator for long duration. Before the use of it take out the refrigerator and put outside in the room temperature (Jain and Vyas, 2002).

Preparation of Bed and Spawning

The 2 kg of lignocellulosic different substrates samples were used for preparation of bed singly wheat, rice and in combination with Wheat + rice, wheat + soybean, wheat + pigeon pea, wheat + green gram in 1:1 proportion and wheat separately as a control. These substrates were transferred into pre-sterilized transparent polythene bag inoculated with 2% of spawn of oyster mushroom. These bags were 200 u in thickness, tied at the top and provide perforation. Polythene bags of 30 X 50 cm with holes. Five layers of 2% spawn were added into the combined or singly substrates.

Incubation

Dry Sterilized substrate samples were filled into the previously cleaned polythene bags separately and inoculated with 2% spawn. After inoculation bags were transferred into incubation room where 20-28^{0}C temperature and 80-90% moisture were maintained (Madan *et al*, 1987). After the complete growth of mycelium, remove the polythene bags. Bed externally and internally covered by white mycelium. After incubation and in controlled conditions fruiting bodies initiation takes place. Count the number and size of fruiting bodies and their weight. Protein content of fruiting bodies on different substrates was determined according to method described by Raghuramulu *et al* (1980) and AOAC(1975).

Harvesting

After 15-19 days incubation, initiation and production of fruiting bodies were takes place. Fruiting bodies numbers were counted per bed. Their size and their fresh weights were also measured separately.

Estimation of Crude Protein: Crude protein was determined by the Macro Kjeldahl apparatus. The protein percentage was estimated using the following formula:

Crude protein (%) = 6:25 × Nitrogen (%)

Table 1: Production and protein content of *Pleurotus* mushroom cultivated on different substrates

S. No.	Substrate used (2 Kg)	Mycelial growth completed (days)	Initiation of fruiting bodies (days)	Number & size of fruiting bodies per bed				Fresh weight (gm/bed)	Protein content (%)
				1-10 cm	11-15 cm	16-25 cm	Total		
1	Wheat (Control)	16	18	21	12	16	49	852	28.62
2	Rice	15	19	19	14	17	50	844	27.85
3	Wheat + Rice (1:1)	15	18	20	15	22	57	920	28.82
4	Wheat + Soybean (1:1)	17	20	18	13	20	51	838	29.35
5	Wheat + Pigeon pea (1:1)	18	21	14	16	15	45	827	28.15
6	Wheat + Green gram (1:1)	17	20	16	15	15	46	843	27.45
7	Wheat + Corn cob (1:1)	19	26	12	16	14	42	813	24.62

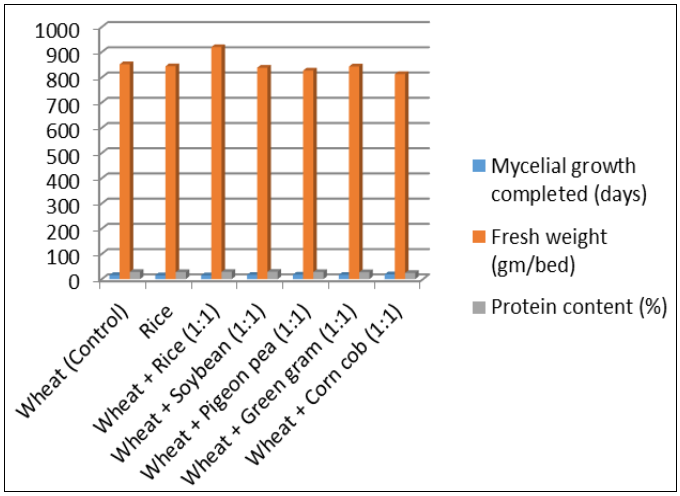

Fig No 1: Mycelial growth, fresh weight and protein content of *Pleurotus sajor caju* on different substrates

Result and Discussion

Mushroom production generates employment and side business for the farmers. Economic condition of farmers can be improved and also helpful for women empowerment. Mushroom cultivation is easy, less input, no land requirement, quick yield and any one can do this. Due to its nutritional values worldwide increased the demand of different edible mushrooms. A little care is required during the authentic source of spawn, multiplication and preservation of spawn. While harvesting the fruiting bodies care must be taken and slowly picking it. Whole substrate and fruiting bodies protect from pathogens was a great task. Packaging and supply freshly or dried form of fruiting bodies to the restaurants and other institutes (Sing N. J. *et al*, 2003).

In the present study different locally available agro wastes were selected for the cultivation of *Pleurotus sajor caju*. These agro wastes were collected from respective fields and stored in the laboratories. Spawn purchased from mushroom research center, agriculture college, Pune. Scientific method followed for the cultivation of *Pleurotus* mushroom *in vitro* (Patrabansh and Madan, 1997). During incubation period necessary moisture, temperature and dark was maintained in the culture room. After incubation mycelial growth, initiation and maturation of fruiting body and further studies were carried out (Madan *et al*, 1987). Results are presented in the Table no.1. It is conclude from the result presented in the Table no. 1 that *Pleurotus sajor caju* was grown on different agro waste (Dundar *et al*, 2009). Recycling of agro wastes were carried out by these techniques. This technique is helpful for decrease in the pollution and generation of employment, enriching economy and women empowerment. It was found that yield of *Pleurotus sajor caju* was significantly increased on Wheat + Rice substrate (920 gm/bed) as compared to other substrates. Followed by fresh fruiting bodies weight found wheat substrate (852 gm/bed), Rice (844 gm/bed), Wheat + Green gram (843 gm/bed), Wheat + Soybean (838 gm/bed), Wheat + pigeon pea (827 gm/bed) and Wheat + Corn cob (813 gm/bed) similar results were obtained by Rajak Shyamal *et al* (2011).

Pleurotus sajor caju is richer source of bioactive compounds like proteins, fibers, minerals, vitamins, low fat and carbohydrates (Bilal and Wani, 2010). Chemical analysis in the form of protein percentage was carried out by Macro Kjeldahl apparatus. It was found from the result that highest protein content was observed on the substrate wheat+ soybean (29.45%), followed by wheat + rice (28.82%), Wheat (28.62%), Wheat + Pigeon pea (28.15%), Rice (27.85%), Wheat + green gram (27.45%) and Wheat + corn cob (24.62%) respectively (Bonatti *et al*, 2004).

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