STUDIES ON UTILIZATION OF SUGARCANE TRASH AS A SUBSTRATE FOR GROWING OYSTER MUSHROOMS.

By.

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B.Sc (Agri.)

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A thesis submitted to the

MAHATMA PHULE KRISHI VIDYAPEETH
Rahuri, Dist. - Ahmednagar,
Maharashtra State,
India.

In partial fulfillment of the requirement for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

AGRICULTURAL MICROBIOLOGY

Department of Plant Pathology,
College of Agriculture,
Pune - 411005.
Maharashtra.

(1997)

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CANDIDATE'S DECLARATION

I hereby declare that the Thesis entitled " **STUDIES ON ULITIZATION OF SUGARCANE TRASH AS A SUBSTRATE FOR GROWING OYSTER MUSHROOM** " or part thereof has not been submitted by me or any other person to any other University or Institute for a Degree on Diploma.

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CERTIFICATE

This is to certify that the Thesis entitled "**STUDIES ON UTILIZATION OF SUGARCANE TRASH AS A SUBSTRATE FOR GROWING OYSTER MUSHROOMS**" submitted to the Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra in the partial fulfillment of the requirement for the award of the Degree of **Master of Science (Agriculture)** in Agricultural Microbiology, embodies the results of a piece of *bona fide* research work carried out by Mr. M.V Nadkarni, under my guidance and supervision, and that no part of the Thesis has been submitted for any other Degree or Diploma or publication in any other form

The assistance and the help recieved during the course of this investigation has been duly acknowledged.

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M V Nadkarni

Place : PUNE (M.V.NADKARNI)

Date 20-9-97

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ABSTRACT

Studies on the utilization of sugarcane trash as a substrate for growing oyster mushrooms.

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The present study was undertaken to find out the suitability of sugarcane trash as a substrate for growing oyster mushrooms.The study revealed that when sugarcane trash alone was used as a substrate, mushroom yield was significantly low. However,the productivity of sugarcane trash could be increased by adding such substrates like paddy straw, in combination, which have a high water holding capacity.

Of the two oyster mushrooms, i.e.*Pleurotus eous* and *Pleurotus florida*, it was observed that the former species required less period for picking than the latter.

It was also observed that both the mushroom species responded differently on different substrates owing to their water holding capacity. A positive correlation was

established between the water holding capacity of the substrates and the yield of mushroom

P eous recorded maximum yield on sugarcane trash + paddy straw (657.5g/kg dry substrate) and minimum on sugarcane trash+ wheat straw (462 g/kg dry substrate) whereas *P florida* recorded maximum yield on paddy straw alone (806 g/kg dry straw) and least on sugarcane trash alone (392 5 g/kg dry substrate)

From the chemical analysis of the spent straw, it was observed that organic carbon decreased during mushroom cultivation.The loss of organic carbon was maximum in paddy straw i.e. 4 18% and 4.41% resptively when *P eous* and *P florida* were used for cultivation, whereas the loss of organic carbon was minimum in sugarcane trash alone when *P eous* (2.42%) and *P florida* (2 29%) were cultivated.

The percent total nitrogen content of the spent substrate was found to be increased The gain was maximum in paddy straw i e 1.27% for *P eous* and 1 32% for *P florida* whereas the gain was minimum in sugarcane trash alone i e. 0.95% for *P eous* and 0 83% for *P florida*

The C.N ratio of the spent straw was found to be narrowed due to mushroom cultivation The minimum C:N ratio was found in paddy straw i e. 19.28 for *P eous* and 18 64 for *P florida* whereas it was maximum in sugarcane trash alone i e 34 63 for *P eous* and 37.9 for *P florida*

INTRODUCTION

1. INTRODUCTION

In recent years, the mushroom cultivation is becoming more and more popular in India in general and Maharashtra in particular The importance of mushroom production can be realised from the following points

1 It doesn't require fertile and cultivable land

2 It produces more food per unit area in unit time than any other traditional food production programme

3 It is the best method for recycling of organic residues without environmental pollution

4 The by-products during mushroom production can be used as cattle feed or can be converted into manure

5 It can generate tremendous employment for both educated and unskilled youth

6 It can help to improve dietary standards

7 Valuable foreign exchange can be earned by growing mushroom as an export oriented business

The cultivation of mushroom is simple and more domestic It is becoming a lucrative job amongst most unemployed youths, housewives besides small and marginal farmers Apart from this, many entrepreneurs and established business houses, are now turning their attention towards mushroom cultivation and processing

The total mushroom production in India during the year 1994-95 has been 25 135 MT This is very low as compared to 20 lakh tonnes in China,and 50,000 tonnes in Korea The major constraints facing the mushroom industry in our country are yield levels which are far below the international standards, and post- harvest management and marketing Among the States, TamilNadu is leading with 4500 MT, followed by Punjab (4200 MT) ,U P (3500MT), Haryana (3000 MT), Himachal Pradesh (2500 MT), and so on during 1994-95(Chadha and Sharma, 1995) The mushroom production in Maharashtra has increased from 250 MT in 1992-93 to 500 MT in 1994-95 (Jadhav and Patil 1995)

Mushrooms have gained tremendous export potential in recent years The major importing countries of dried mushroom from India are Germany, Switzerland and France, and of preserved mushroom are U S A and Canada Among the Asian countries, China, Indonesia, Taiwan, and Korea are the major canned mushroom exporting countries to U S A But during 1993 and 1994, India has replaced Taiwan for the first time by exporting the processed mushroom to U S A (Achin 1995) It is estimated that by 2025 AD, the total mushroom production may cross 100,000 MT in India It may emerge as a leading mushroom exporting country in Asia

Of the total production of mushroom in the world, button mushroom contributes 37 7 percent , followed by oyster mushroom with 24 4 per cent, Shiitake and Auricularia with 10 6 percent and paddy straw mushroom only 5 5 percent

Table a. The export of mushroom from India during the period of 1990-94

	Fresh/Chilled	Dried	Prepared/Preserved	Total value (Rs lakh)
1990-91 Qt (MT)	-	44 51	128 00	
Value (Rs lakh)	-	745 32	76 33	821 66
1991-92 Qt (MT)	3 76	49 17	1174 76	
Value (Rs lakh)	20 05	1222 40	381 10	1623 55
1992-93 Qty (MT)	110 53	37 70	3294 20	
Value (Rs lakh)	80 78	903 32	1081 80	2065 90
1993-94 Qty(MT)	41 53	39 40	4811 48	
Value (Rs lakh)	19 03	859 76	1514 73	2393 51

Source - Advances in Horticulture vol 13 Mushroom (1995)

Cultivation of oyster mushroom is particularly suited for a tropical country like India having high humidity and average temperature around 25^0-30^0C, morever there is an abundance of substrate in the form of agricultural wastes Oyster mushrooms have been cultivated on a variety of crop residues like paddy straw ,wheat straw, hulled maize cobs, pea straw, jowar straw, groundnut seed husk, sugarcane bagasse, cotton waste etc (Bahukhandi and Munjal, 1989 and Patil *et al*, 1989)

Sugarcane trash is an important agricultural waste in the region where sugarcane is grown as a cash crop In Maharashtra, this crop is predominantly grown in the districts of Kolhapur, Ahmednagar, Nashik, Satara, Sangli and Solapur The availability of sugarcane trash per annum is about 1023 thousand tonnes Therefore a part of such huge amount of

trash could be effectively used for converting it into valuable nutritious food in the from of oyster mushrooms

There are about 12 species of oyster mushrooms commonly cultivated in India they are -

1) *Pleurotus sajor-caju* (Fr) Singer

2) *Pleurotus flabellatus* (Berk and Br) Sacc

3) *Pleurotus ostreatus* (Jacq) Fr

4) *Pleurotus florida* Eger

5) *Pleurotus citrinopileatus* Singer

6) *Pleurotus cornucopiae* (Paul ex Fr) Sing

7) *Pleurotus tuberengium* (Fr) Singer

8) *Pleurotus membranaceous* Masse

9) *Pleurotus eryngii* (DC ex Pers) Quel

10) *Pleurotus fossulateus* (Fr) Sing

11) *Pleurotus eous* (Berk) Sacc

12) *Pleurotus platypus* (Crook and Masse) Sacc

Presently *Pleurotus sajor-caju* which is ash grey in colour and *Pleurotus florida* which is snow white have been recommended in Maharashtra (Jadhav and Patil 1995), whereas *Pleurotus eous* which is pink in colour which has been reported to grow well in the State of Karnataka (Prabhu Dessai *et al*., 1991)

It was therefore felt worthwhile to compare the performance of pink mushroom with recommended species of *Pleurotus florida* on different combi-nations of sugarcane trash with other substrates

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

A brief review of literature pertaining to the cultivation aspects of oyster mushrooms is presented in this chapter

2.1 Cultivable species of oyster mushrooms.

Bano and Srivastava (1962) were the first to standardize the cultivation of oyster mushroom in India by successfully growing *Pleurotus flabellatus* on paddy straw

Jandaik and Kapoor (1975) while surveying the foot hills of Himalayas, for edible fungi,found a species of *Pleurotus* growing on decaying plants of *Uphorbia royleana* The fungus was later identified as *Pleurotus sajor-caju* It was readily brought into pure culture by transfering a bit of tissue on P D A slant Its morphology and cultural characters were described

Jandaik (1977) reported commonly grown oyster mushrooms which included *Pleurotus ostreatus, P sajor-caju , P eryngii, P flabellatus* and *P.tuberengium* He also discussed the constraints related to their cultivation mainly yield reduction, colour attractiveness, thickness of flesh, breeding of sporeless strains and selection of strains

Singh and Rajarathnam (1977) grew a new mushroom spp *Pleurotus eous* on water soaked chopped paddy straw in circular plastic boxes and in shallow or deep rectangular wooden trays (60 x 90 x 17 5 cms) The protein content of the mushroom amounted to 33 % (dry weight basis)

Gupta *et al*, (1983) cultivated pink mushroom (*P eous*) on chopped straw at 28^0C and RH 60-90% The fruiting bodies were found to contain 1 5 to 5 6 percent reducing sugar,

0 31% non reducing sugar and 27 4 % protein Contents of individual amino acid were estimated alongwith yield data for *P ostreatus* and *Agaricus bisporus*

Martonfy (1983) studied two new cultivars of oyster mushroom viz the late cropping L sz (*P ostreatus*) and the summer cropping strain C-751 (*P florida*) The trial of L sz and PS (control) yielded 255 1 and 157 7 kg/ton of substrates respectively over 6-8 weeks in 3 flushes while C-751 grown in summer and autumn produced an average yield of 259 6 Kg/ ton of substrate over 4-6 weeks in 2 flushes in summer and 3 flushes in autumn

Ghosh and Chakravarty (1986) for the first time reported the species of *P citrinopileatus* and standardised its cultivation techniques

Lu (1987) introduced *Pleurotus florida* from German Federal Republic He reported that under same conditions of temperature,moisture, light, air and pH *Pleurotus florida* showed faster and stronger growth than *Pleurotus ostreatus* and *P viosporium* and contained higher levels of protein and amino acid than other common species of the genus

Prabhu Dessai *et al*, (1991) found a pink coloured oyster mushroom growing on dead wood in the forest of Thumbane in Karnataka A pure culture was isolated from stipe portion On paddy straw it produced pink coloured oyster mushroom within 10-12 days Biological efficency of *P sajor-caju* was found slightly higher (95 92 %) than that of pink *Pleurotus* (88 15 %) Nutritionaly pink *Pleurotus* was found to be at par with *P sajor-caju*

2.2 Effect of physical factors such as temperature, humidity, light intensity, etc. on growth and yield of oyster mushroom.

Schmaus (1973) observed that *P ostreatus* had a vegetative growth period of 2-3 weeks It grew well at a temperature of 22^0 - 24^0C with high humidity and free ventilation

Leong *et al*, (1978) cultivated *Pleurotus florida* using perforated polyethylene bags as containers to hold 2 Kg of unsterilised raw cotton waste as a substrate The spawn was placed in layers, and bags were held at $20^0 \pm 3^0$C for 9 to 21 days and at 26^0- 30^0 C for fruiting Five flushes were harvested at 7-10 days interval

Kiran (1983) reported that *Pleurotus flabellatus* produced maximum biomass in the synthetic medium when the temperature was maintained at $25^0 \pm 1^0$ C, pH at 5 5 and 14-16 days incubation period

Yang (1984) studied the effect of light intensity and its quality on the growth of *Pleurotus sajor-caju* He observed that strong illumination (600 lx) was unfavorable for mycelial growth while diffused light (30 lx) had little effect The mycelium grew under yellow light and green light but was inhibited under red and blue light

Visscher (1984) conducted trials with *Pleurotus ostreatus*, *P pulmonarious* and *P columbinus* to observe the effects of pasteurization temperature of 58^0C or 70^0C, and mycelium growth temperature of 20^0 or 25^0C in all possible combinations Pasteurization at 58^0C followed by 25^0C for mycelium growth usually gave the best results

Mehta and Bhanda (1988) studied mycelial growth variation of six *Pleurotus* spp at different temperatures The growth rates of *P ostreatus*, *P. sapidus*, *P cystidiosus*, *P*

sajor-caju,P florida and *P flabellatus* at 10^0, 15^0, 20^0, 25^0, 30^0, 35^0 and 40^0C were studies on P D A medium The time taken for complete colonization of a petridish (7cm in diameter) was 13-15 days at 15^0C, 10-12 days at 20^0C, 8-11 days at 25^0C and 9-16 days at 30^0C No growth was observed at 10^0, 35^0, and 40^0C upto 15 days P cystidisus grew particularly slow at 30^0C

Bhattacharjee and Samajpati (1989) investigated the mycelial growth of *P sajor-caju* in relation to the effects of different temperatures (15^0 -45^0 C), light intensities and duration, pH (4 0-7 5), carbon source (sugars and starches) and Nitrogen sources (organic and inorganic) The dry weight yield of mycelium was greatest under the following conditions, 25^0C, complete darkness, phosphate buffer at pH 5 5, either starch or dextrin as carbon source and Asparagine as Nitrogen source

Polaik and Ginterroria (1989) reported high degree of correlation between surface and internal temperatures of substrates, measured during mycelial growth The optimum temperature was 25^0 - 27^0C Above 32^0-34^0C, the mycelium died, and below 10^0C growth stopped At room temperature (20^0C) a substrate layer thickness of 24 cm was found to be optimum Direct sunlight was avoided Maximum surface temperature was reached on the 6^{th} day after inoculation and over heating was avoided by increasing air circulation ,or water spraying when a temperature of 32^0C was reached

Diwakai (1990) studied effect of various treatments on paddy straw on yield of some cultivated species *Pleurotus sajor-caju, P sapidus, P ostreatus, P florida, P. obolonus and P flabellatus* The substrates were subjected to

(a) autoclaving at 30 lbs p s i for 30 min

(b) steaming without pressure at 65^0-75^0C for 2 hours Immersing the straw in 5% formalin and covering with tarpaulin for 6 hours

(d) Immersing in boiling water 90^0-95^0 C for ½ hour and 60^0- 70^0C for 2 hours

(e) Composting of heap 3 ft turning after 48 hour

(f) Only soaking in water as control

It was observed that steamed and autoclaved bags gave highest yield followed by hot-water and composting while chemical and tap water were less effective

2.3 Effect of different substrates on yield of oyster mushrooms.

Jandaik and Kapoor (1975) cultivated *P sajor-caju* on a variety of farm waste products viz banana pseudostem, paddy straw, wheat straw compost and saw dust High yield was obtained with banana pseudostem and chopped paddy straw

Quimio (1979) cultivated Pleurotus flabellatus on several agricultural waste material and found rice straw and hulls, banana bracts, baggase, coirdust and leaf littre suitable for growing the oyster mushroom

Bano *et al*, (1979) conducted experiment at Mysore, and obtained high yeild of *Pleurotus flabellatus* on rice straw as against wheat and ragi straw

Sivaprakashan and Kandaswamy (1981) used waste paper, baggase of sugarcane, hulled cobs of maize, straw of rice, dried flowers of *Delonix regia* (Gulmohar), coir waste or coconut pericarp, wood shavings and ears of ragi for growing *Pleurotus*

sajor-caju and reported higher yield of sporophores on waste paper, sugarcane baggase and hulled maize cobs followed by rice straw

Platt *et al*, (1982) observed higher yield of *Pleurotus ostreatus* on cotton straw as compared to wheat straw. It was also observed that the mycelial growth was quicker and fruiting was obtained within 23 days.

Bisht and Harsh (1983) cultivated *Pleurotus ostreatus* on dried tealeaves which were mixed to a pulp with water and placed in wooden trays (25x25x20cm) Crops were picked from the trays for 5-6 months and yeild were 40-60% of weight of the substrate

Gaikwad (1983) made a comparitive study of yield potential of different *Pleurotus spp* using selected agricultural wastes i.e wheat straw, sugarcane trash etc *Pleurotus flabellatus, P florida, P ostreatus,* and *P sajor-caju* were used for cultivation It was observed that *P flabellatus* grew successfully in sugarcane trash and wheat straw, while *P florida* on sugarcane baggase and produced more yield as compared to *P ostreatus* and *P sajor-caju*

Madan *et al*, (1987) tested leaves of *Morus alba* and *Ricinus comminis* as a substrate for cultivating *P sajor-caju* The yield obtained from *M alba* was comparable with the yield obtained from paddy straw.

Ramesh and Ansari (1987) used several locally available substrates from the Andamans viz rice straw, banana leaves, saw dust, oil palm refuse, oil palm bunch refuse and grass straw to study conversion efficiency of *Pleurotus sajor-caju* Rice straw and

banana leaves showed the conversion efficiency of 60% and more The mean of the fruiting body was high (7 1g) on banana leaves compared with other substrates (2 1-5 0g).

Patil *et al*, (1989) studied cultivation of *Pleurotus sajor-caju* on different substrates i e wheat straw, paddy straw, stalks and leaves of jowar, bajra, maize and cotton The results indicated that all the substrates tested could be used for commercial cultivation of oyster mushroom. The cotton stalks recorded the highest yield (2361 g/10kg wet substrate) followed by paddy straw (1463 g/10kg wet substrate)

Mahajan and Jadhav (1989) observed highest yield of fresh oyster mushroom (P. sajor-caju) in paddy (643.33 g/kg straw) followed by sorghum, bajra, mung, maize, sunflower and sugarcane leaves.

Bahukhandi and Munjal (1989) used four species of *Pleurotus sajor-caju, P sapidus, P ostreatus* and *P florida* for cultivation on different agricultural residues They showed that groundnut seed husk, gram seed husk and cotton waste (first grade dropping waste) proved marginally better than the commonly used substrate i e paddy straw Bajra straw, Kauni straw and jowar straw proved to be very poor yielders for all four *Pleurotus* species

Kothandaraman *et al*, (1989) and Jacob Mathew et al. (1991) carried out preliminary trials of cultvation of oyster mushroom on rubber wood waste and rubber processing factory wastes respectively and found these wastes to support the growth of mushroom

Singh and Singh (1991) used soybean straw, wheat straw and paddy straw singly as well as in combination for production of *Pleurotus sajor-caju* The highest yield (729 g/kg substrates) was recorded from the soybean straw when used singly When wheat straw and paddy straw were used in different ratio with soybean straw, the combination of soybean straw + wheat straw (1:1) gave higher yield over others.

Thilagavathy *et al*; (1991) used substrates like silk cotton chips (SC), banana pseudostem (BP), Kuthiravali millet stalk (KS) and sorghum stalk (SS) in combination with paddy straw (PS) in 1 1 dry weight combination for testing the yield of oyster mushroom (*Pleurotus sajor-caju*). Maximum yield (963.58 g/kg dry matter) was observed in BP followed by SC,KS, and PS. Maximum size (33.3cm^2) and weight (99g) of individual mushroom was observed in S.C.

Pandey and Tewari,(1991) evaluated tea and coffee wastes for cultivation of *Pleurotus florida* with different ratio (25,50,75%) of paddy straw Pure tea waste and coffee waste however gave lower yield

Patil and Jadhav (1991) used 14 substrates seperately and in 3 combinations to assess the productivity of *Pleurotus sajor-caju* Cotton stalk produced significantly more mushroom (1505 g/kg dry substrate) than all other substrates studied. Sugarcane trash recorded the least mushroom yield (305 g/kg dry substrate)

Singh and Singh (1994) evaluated wheat and paddy straw substrates at different farmer's houses for the cultivation of *Pleurotus sajor-caju* in natural condition Wheat straw substrates proved significantly superior over paddy straw substrates

Kumar and Shukla (1995) conducted trials at the Indira Ghandhi Krishi Vishwa Vidyalaya, Raipur campus, M P and a technology was standardized The results indicated that cultivation of oyster mushroom has high potential even in village huts using dry straw of wheat or paddy About 500-700g mushroom per kg straw, of *Pleurotus florida* was harvested using paddy straw as the substrate

2.4 Effect of different supplementation of substrates on yieldof oyster mushroom.

Bano (1971) used Bengal gram powder and oat meal to supplement paddy straw for cultivation of *Pleurotus flabellatus* Oat meal gave high yield 365 g/kg dry paddy straw as compared to 361.6 g fresh mushroom per kg of dry paddy straw containing Bengal gram powder.

Visscher (1984) in his trials with *Pleurotus ostreatus* , *P pulmonarius* and *P columbinus* compared the effects of amending the dry straw substrate with rice bran at 0,7 5 or 15% Yield were markedly improved by amendment with the highest concentration giving the best results.

Sivaprakasan (1986) found that none of the pulses (*Vigna mungo, V radiata, Cajanus cajan* and others) or grains (*Zea mays, Sorghum vulgare, Setaria italica* and others.) applied in powder form had a beneficial effect of sporophore production

Bisaria *et al* (1987) reported that the biological efficency of *Pleurotus sajor-caju* was maximum on paddy straw supplemented with cotton seeds

Gapinski and Ziombra (1988) conducted a trial on mycelial growth of *Pleurotus ostreatus* and *Pleurotus florida* on

a) rye + wheat straw + maize husk.

b) Pine + beech sawdust

c) Pine + beech bark at 5^0-35^0C.

The growth of both species was most rapid on substrate (a). The optimum temperature was 25^0C on all substrates. *Pleurotus ostreatus* mycelium grew faster than *P florida* mycelium

Ma (1988) supplemented rice straw with ground maize, sugar, urea, gypsum for the cultivation of *Pleurotus florida.*

Macaya-Lizano (1988) cultivated *Pleurotus ostreatus*, *P salignus* and *P florida* on a different media in boxes under good ventilation , natural light and an ambient temperature. Good results were obtained on 4 media. A mixture of 50% sugarcane baggase + 15% sawdust + 20% rice husk gave the best yield (50-55 g/100 g dry medium) The basic medium (60% rice straw + 20% saw dust + 20% rice bran) serving as the control yielded 19-22 g/100g dry meduim.

Mahmoud and El-Kaltan (1989) reported that yield was significantly increased by supplementation of wheat bran, dried green clover and soybean flour in to paddy straw

Visscher (1989) conducted a trial with different strains of *P ostreatus*, *P pulmonarius* and *P columbinus* on the effect on yield, on adding various amendments to the straw substrates The amendments comprised of rice bran, lucern meal, Milli champ 300

(soybean meal), poultry manure and gypsum Lucern meal gave better results than rice bran

Chander Rao (1991) studied the supplementation of the substrate with rice bran, cashew waste and brewer's grain at 4% level on wet weight basis showed increase in yield of *Pleurotus florida* to the tune of 9%, 11%, and 14% respectively

2.5 *Biotransformation brought about in the substrate due to mushroom cultivation.*

Rangaswamy *et al,* (1975) reported that the nitrogencontent of the substrate steadily increased upto 30 days of spawning, after which there was a decline He believed the increase in nitrogen content of substrate was due to nitrogen fixing by the oyster mushroom

Ortaga *et al*, (1986) reported *Pleurotus ostreatus* cultivated on barley straw for 45-60 days and recorded significant reduction in hemi-cellulose and cellulose content in straw used for mushroom cultivation

Bisaria *et al*, (1987) studied biochemical changes effected in the substrates as a result of mushroom growth in terms of nitrogen content and degradation of cellulose , hemi-cellulose and lignin components.

Amanat *et al*, (1987) reported an increase in the crude protein content of wheat and paddy straw after growing *Pleurotus ostreatus* The crude protein of the wheat straw increased from (3 54% to5 33%) and in rice straw from (8 52% to12 68%) The fungal

treatment dramatically reduced the content of hemicellulose from 25 10% to 16 28% in wheat and from 15 36% to 8.45% in rice straw

Gupta and Longer (1988) reported upgradation of nutritive value of wheat straw used for the cultivation of *Pleurotus florida*

Li and Wang (1989) evaluated the nutritive value of the substrate after cultivation of *Pleurotus sapidus* with a view to use it as a poultry feed.They reported an increase in crude ash content and crude protein and decrease in crude fibre content of cotton waste

Rajarathnam and Zakia Bano (1989) studied biotransformations of natural lignocellulosic waste due to *Pleurotus* cultivation and reported that in general cellulose , hemicellulose and lignin were degraded , the solubility of the substrate increased and sugar, amino acid and ash contents were increased

Prabhu Dessai *et al*; (1991) examined the substrates such as paddy straw, maize cobs, coir dust and groundnut shells , periodically at 0,24 and 50 th day of cropping of mushroom for carbon, nitrogen, water soluble and ethanol benzene soluble extracts , cellulose , lignins and hemicellulose .

Jadhav (1995) conducted an experiments to find out the effect of different substrates on yield and quality of mushroom (*Pleurotus sajor-caju*) The study revealed significant changes in the physico-chemical composition of the substrates due to mushroom cultivation Nitrogen content of different substrates was found to be increased upto 3 14%

The carbon content and C:N ratio were reduced upto 66 8% and 20 15% resp On the other hand Calcium and Phosphorus content of different substrates were increased

MATERIAL AND METHOD

3. MATERIALS AND METHODS

The experiment was conducted at the All India Co-ordinated Mushroom Improvement Project (A I C M I P), College of Agriculture, Pune-5

3.1 Substrates utilized for cultivation of the oyster mushrooms.

The various substrates required for growing oyster mushrooms were collected from the Pune Agril college farm Paddy straw was obtained from Agricultural Research Station, Vadgaon Maval The substrates used were not more than one year old The types of substrates used are as below

1) Sugarcane trash (Co - 7219)

2) Paddy straw (Ambemohar)

3)Wheat straw (Raj 1555)

4) Cotton stalk (Local var)

5) Soybean stalk (MACS 57)

Soybean meal (MACS 57) was used as a supplement, after grinding seeds to 100 mesh with the help of electric grinder

3.2. Spawn

Fresh spawn of oyster mushroom (15 days old) was used The spawn of pink mushroom (*Pleurotus eous*) and *Pleurotus florida* were made available by the Officer-in-Charge, All India Co-ordinated Mushroom Improvement Project, College of Agriculture, Pune-5

3.3 Preperation of beds

The straw used as a substrate was first chopped into smaller pieces of 5-6 cm length For various combinations, the respective straws were thoroughly mixed in the proportion of 1 1 on dry weight basis . The chopped straw was soaked overnight along with a gunny bag in fresh water for a period of 14-18 hours, depending upon the water holding capicity of the straw The excess water was allowed to drain off This substrate was then pasteurized by steam at 80^0 C for 1 hour (Patil *et. al.*, 1989) After cooling the substrate,it was filled in polythene bags @ 1 Kg dry weight per bag Before filling,the bags were disinfected with 2% Formalin solution The spawning was done by layer method @ 2 per cent on the wet weight basis After inoculation, the polythene bags were tied, labelled and perforated at 20-25 points with help of sterile pin for aeration

3.4 Observation of mycelial growth

The beds after inoculation or spawning were incubated for a period of 10 to 15 days After the complete spawn run in the substrate, the polythene bags were cut open and kept on shelves Observations regarding days required for completion of spawn run,and pin head initiation were recorded

3.5. Management of the envirnonment

The temperature and humidity of the cropping room were maintained in the range of 22^0 to 28^0 C and 80 to 90 per cent respectively Watering of the beds and its surrounding was done atleast twice a day or as per requirment

3.6 Experimental details

The beds of the oyster mushroom were prepared in the polythene bags using single substrate and their combinations as given under treatment details

Design of the experiment

Factorial Randomized Block Design (F R B D) comprised of seven treatments replicated twice using two species of oyster mushroom viz , *Pleurotus eous* (Pink mushroom) and *Pleurotus florida*

Treatment details

T1 - Sugarcane trash alone

T2 - Paddy straw alone

T3- Sugarcane trash + cotton stalk (1 1)

T4- Sugarcane trash + wheat straw (1 1)

T5- Sugarcane trash + paddy straw (1 1)

T6- Sugarcane trash + soybean straw (1 1)

T7- Sugarcane trash + soybean meal (2%)

The treatments T1 and T2 were considered as control

3.7 Harvesting

In all the treatments, the mushrooms were harvested in 2-3 flushes The sporophores were harvested at the proper stage i e before spore shedding Observations

regarding days required for first picking from the day of spawing were recorded A number of sporophores harvested was also recorded The yield was recorded in grams per Kg/dry weight of the substrate

3.8 Chemical analysis of fresh and spent straw used for growing oyster mushroom.

The analysis of the substrate in respect to water holding capicity,total nitrogen (Micro - Kjeldahl's method) and organic carbon (Ignition method) was carried out using standard methods (A O A C ,1975, Tandon, 1994)

The water holding capacity of the substrate was determined by soaking 100 g substrate in excess water in a flask The substrate was soaked for 14-18 hours,and the excess water was drained off The gain in weight of the substrate after draining the water, was considered as the water holding capacity of the substrate

The chemical analysis of the spent straw after mushroom cultivation was carried out to evaluate the status of Nitrogen and Organic carbon by using the mentioned standard method

3.9 Statistical analysis

The statistical analysis of the data was done by using standard statistical methods (Panse and Sukhatme 1978).

PLATE 1 : First Flush of *Pleurotus eous* on Sugarcane trash alone.

PLATE 3 : First Flush of *Pleurotus eous* on Sugarcane trash + Cotton stalk.

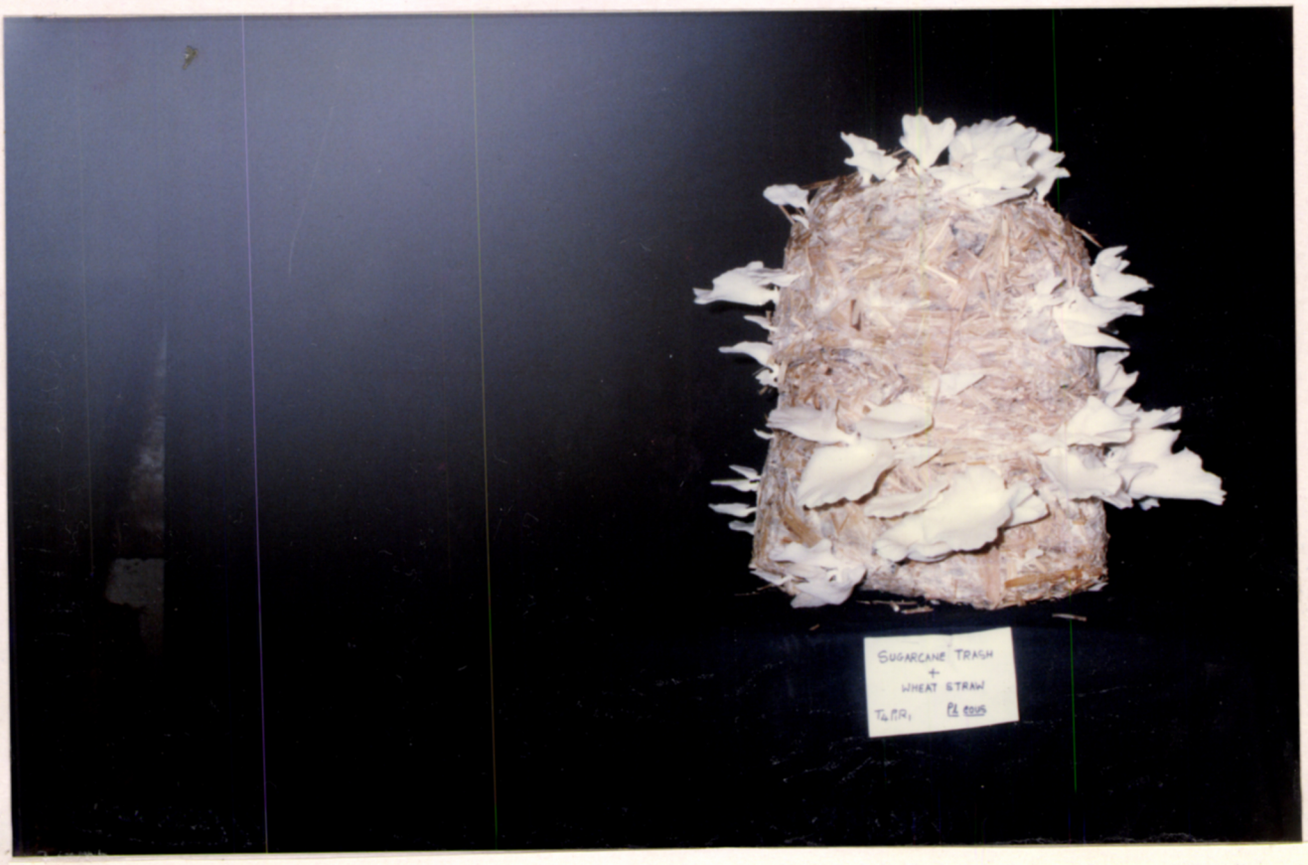


PLATE 5 : First Flush of *Pleurotus eous* on Sugarcane trash + Paddy straw.

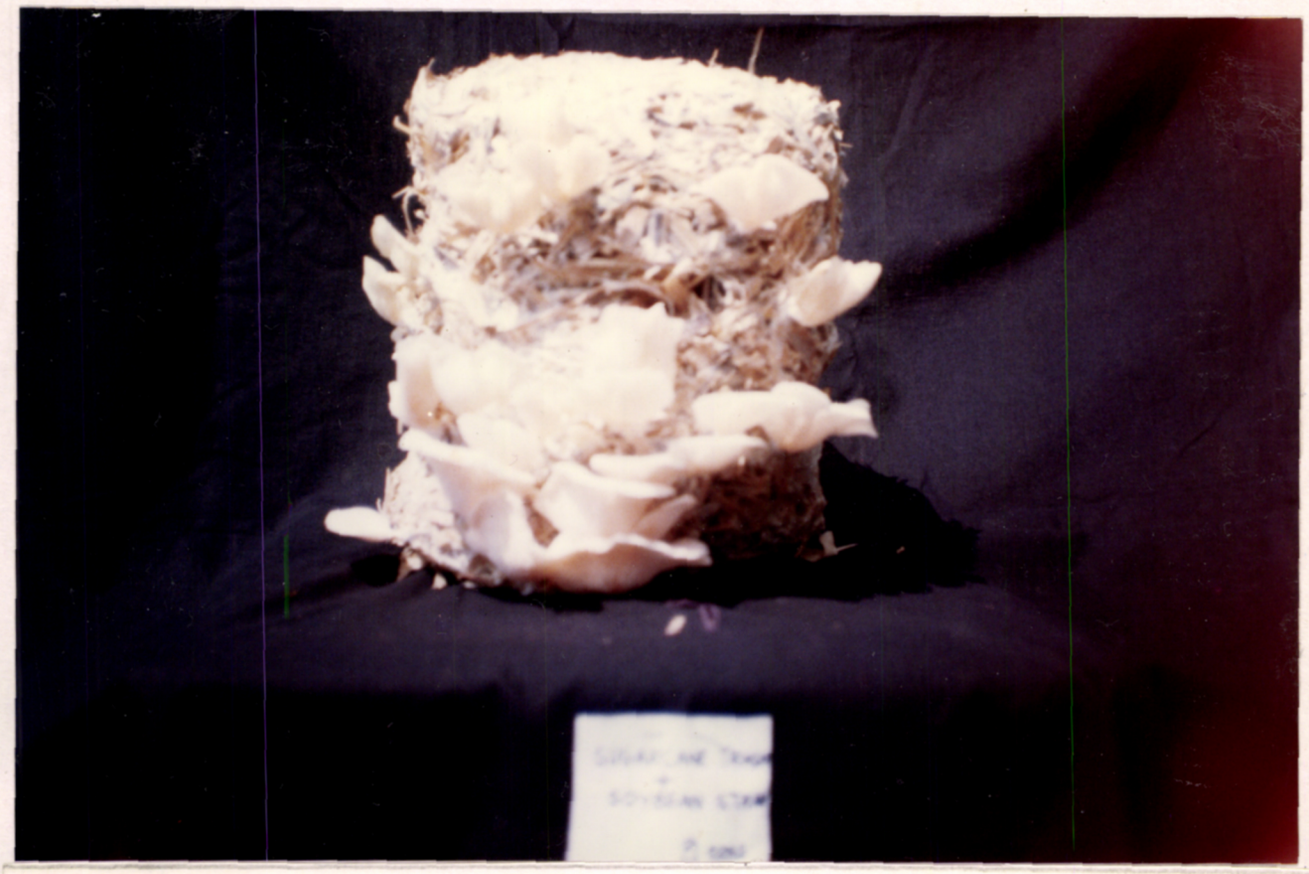


PLATE 6 : First Flush of *Pleurotus eous* on Sugarcane trash + Soybean straw.

PLATE 7 : First Flush of *Pleurotus eous* on Sugarcane trash + Soybean meal.

PLATE 8 : First Flush of *Pleurotus florida* on Sugarcane trash alone.

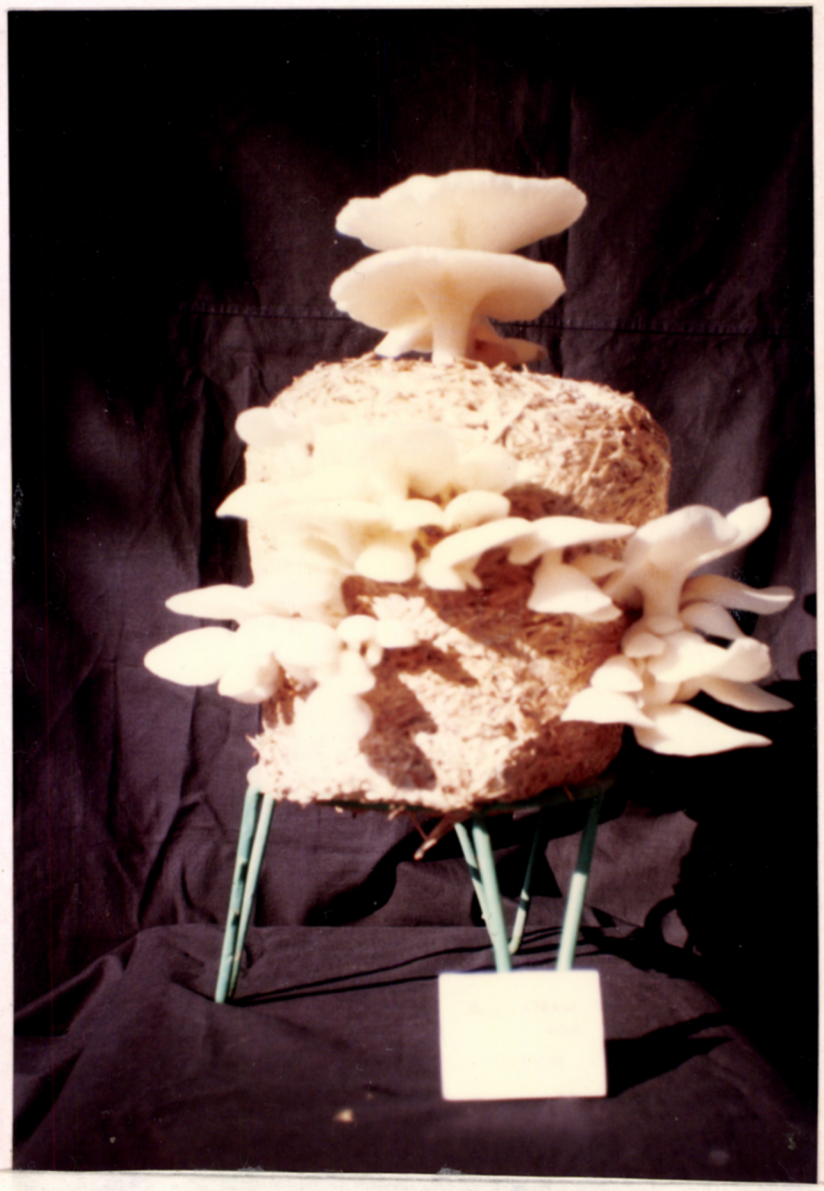


PLATE 9 : First Flush of *Pleurotus florida* on Paddy straw alone.

PLATE 10 : First Flush of *Pleurotus florida* on Sugarcane trash + Cotton stalk.

PLATE 11 : First Flush of *Pleurotus florida* on Sugarcane trash + Wheat straw.

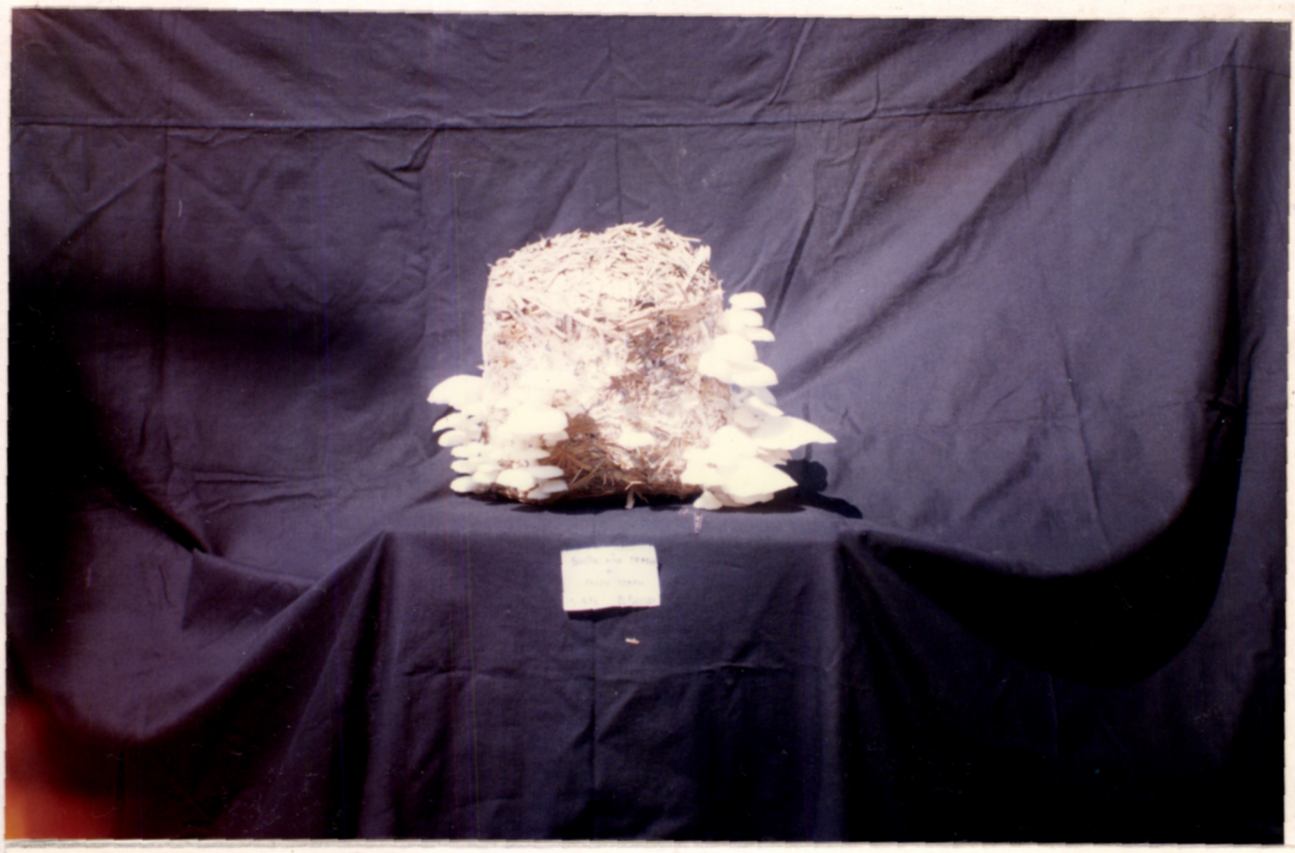


PLATE 12 : First Flush of *Pleurotus florida* on Sugarcane trash + Paddy straw.

PLATE 13 : First Flush of *Pleurotus florida* on Sugarcane trash + Soybean straw.

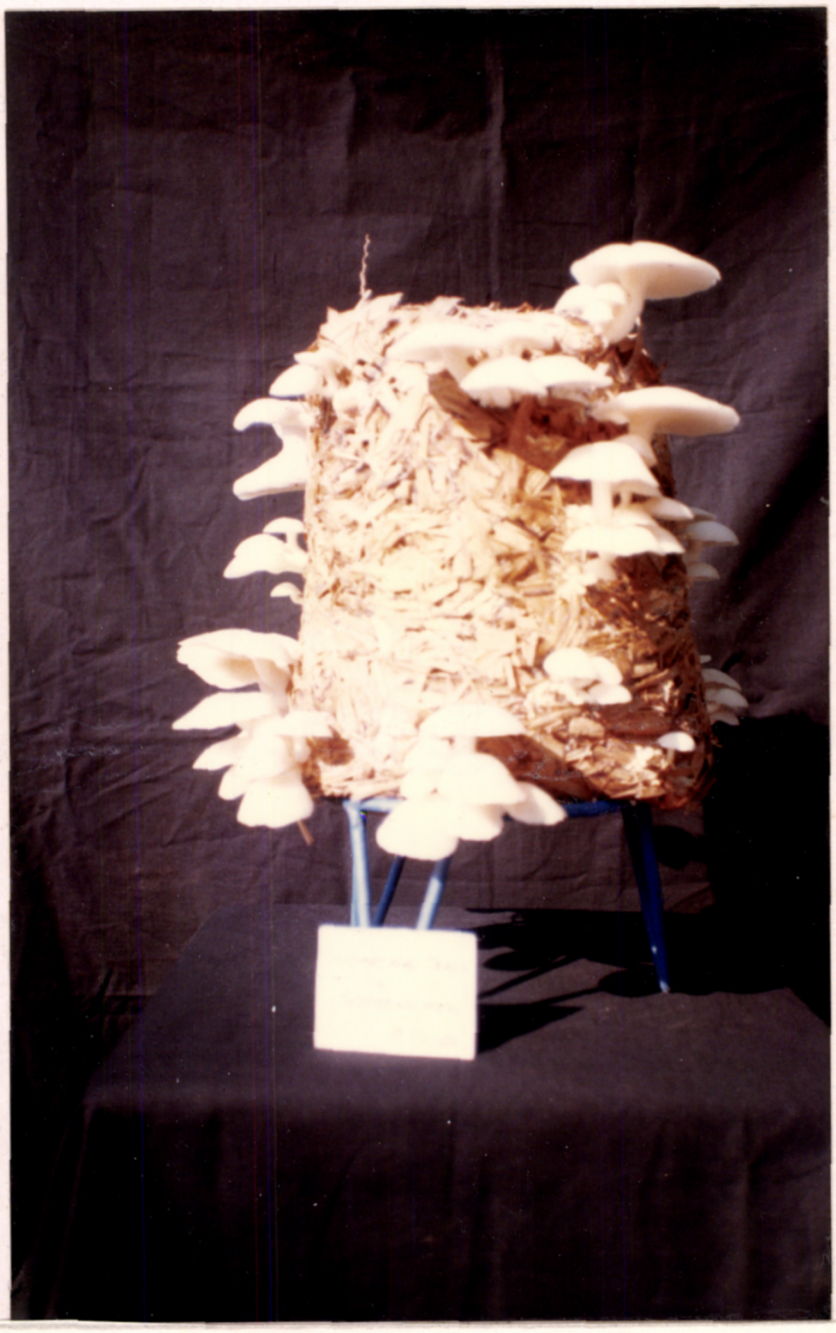


PLATE 14 : First Flush of *Pleurotus florida* on Sugarcane trash + Soybean meal.

RESULTS AND DISCUSSION

4. RESULTS AND DISCUSSION

The results of the present investigation on utilization of sugarcane trash as a substrate for growing oyster mushroom are presented and discussed in this chapter

4.1. Observations regarding the time required for completion of spawn run.

From the Table 1 it is observed that out of the two species of *Pleurotus* used for cultivation viz *Pleurotus eous* and *Pleurotus florida* the former took lesser time than the later for complete spread of mycelium on the substrate As far as the spawn run of the individual species on each treatment is concerned it was seen that *Pleurotus eous* took only 8 days in case of treatment T3 (sugarcane trash + cotton stalk), where as it took 14-15 days in T1 (sugarcane trash alone) Similarly *Pleurotus florida* required significantly more time of 16 5 days in T1 than T3 (12 5 days).

Both the species required the shortest time of 10 25 days for spawn run in substrate T3 (Sugarcane trash + Cotton stalk),whereas they required the longest period of 15 5 days in substrate T1 (Sugarcane trash alone).

4.2. Period required for pin head appearance

From the data given in Table 2 it is evident that the pin head appeared earlier in *Pleurotus eous* than *Pleurotus florida* in all the treatments. *Pleurotus eous* recorded pin heads in just 11 days when grown on sugarcane trash + cotton stalk (T3) and took 19 5 day when cultivated on sugarcane trash alone (T1). It was also observed that for *P eous*, treatments T2 and T3 were at par with each other

Table 1. Days required for complete spawn run on the substrate

Sr. No.	Treatments	No. of days required						
		P. eous			*P. florida*			
		RI	RII	Mean	RI	RII	Mean	Pooled Mean
T1	Sugarcane trash alone	15	14	14.5	16	17	16.5	15.50
T2	Paddy straw alone	9	8	8.5	15	14	14.5	11.50
T3	Sugarcane trash + cotton stalk	8	8	8.0	12	13	12.5	10.25
T4	Sugarcane trash + wheat straw	11	10	10.5	15	15	15.0	12.75
T5	Sugarcane trash + paddy straw	9	9	9.0	14	14	14.0	11.50
T6	Sugarcane trash + Soybean straw	11	10	10.5	15	15	15.0	12.75
T7	Sugarcane trash + Soybean meal	11	12	11.5	17	15	16.0	13.75
Mean				10.35			14.78	

SE for treatments = 0.311
CD at 5% = 0.94
SE for species = 0.166
CD at 5% = 0.5
SE for interaction = 0.439
CD at 5% = 1.33

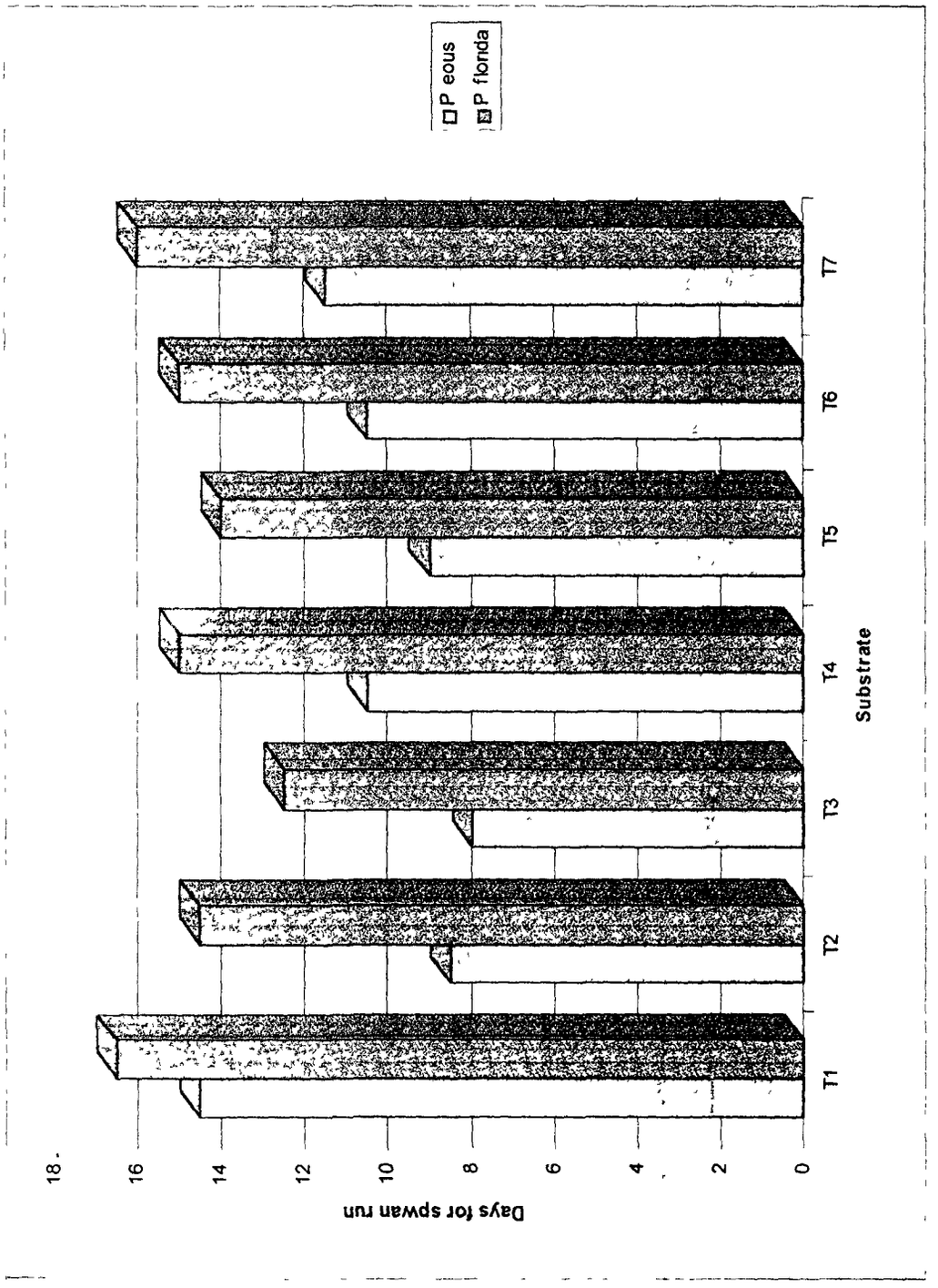


Fig. 1 Period required for complete spawn run.

Table 2. Days required for pin head appearance from the day of spawning

Sr. No.	Treatments	No. of days required						
		P. eous			*P. florida*			
		RI	RII	Mean	RI	RII	Mean	Pooled Mean
T1	Sugarcane trash alone	20	19	19.5	22	22	22.0	20.75
T2	Paddy straw alone	13	11	12.0	20	19	19.5	15.75
T3	Sugarcane trash + cotton stalk	11	11	11.0	18	18	18.0	14.50
T4	Sugarcane trash + wheat straw	15	14	14.5	19	19	19.0	16.75
T5	Sugarcane trash + paddy straw	14	13	13.5	19	17	18.0	15.75
T6	Sugarcane trash + Soybean straw	15	15	15.0	20	18	19.0	17.00
T7	Sugarcane trash + Soybean meal	16	16	16.0	22	21	21.5	18.75
	Mean			14.5			19.5	

SE for treatment = 0.273

CD at 5% = 0.823

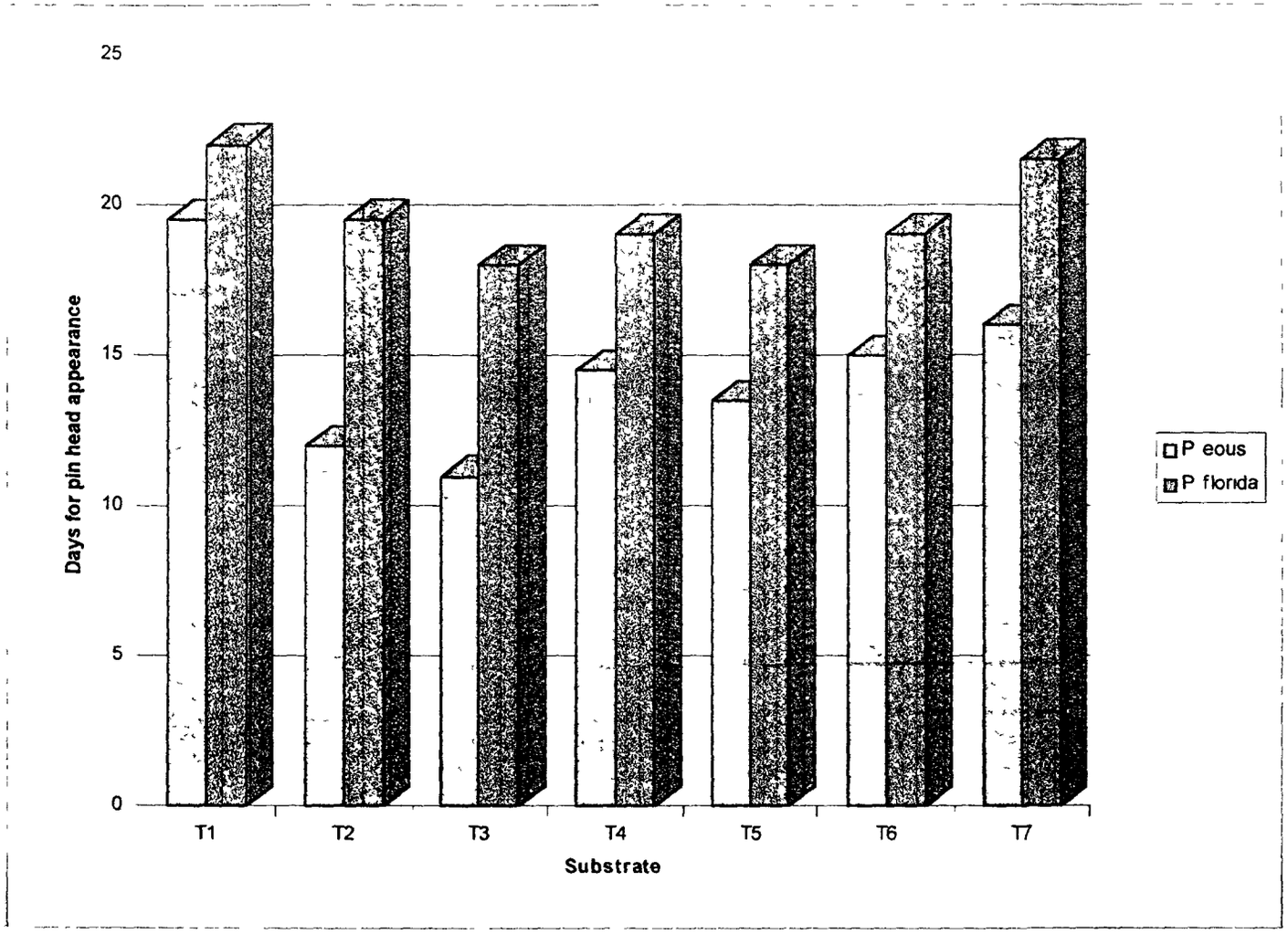
SE for species = 0.145

CD at 5% = 0.44

SE for interaction = 0.386

CD at 5% = 1.167

Fig. 2 Period required for pin head appearance



Pleurotus florida took the least time of 18 days from the day of spawning for pin head appearance in treaments T3 and T5 It took 19 days in T4 and T6 It was also observed that for *P florida* treatments T3, T4, T5 and T6 were at par and T1 and T7 were at par with each other.

When the substrates were considered for their effect on pin head appearance irrespective of the mushroom species, it was observed that substrate T3 induced early pin head appearance (14 5 days), whereas pin heads appeared in substrate T1 after 20 75 days Both the species required 15 75 days in T2 and T5 for initiation of primordia

4.3 Observations regarding period required for first picking

The data reported in Table 3 shows the time span required for the harvesting of first flush from the date of spawning. It was observed that *Pleurotus eous* required shorter period as compared to *Pleurotus florida* .

P eous recorded the shortest period for the first flush in treatments T2 and T3 i e paddy straw alone and sugarcane trash + cotton stalks. Where as in treatments T4 (sugarcane trash + wheat straw) and T6 (sugarcane trash + soybean straw) it took 18 5 days In treatment T1 (sugarcane trash alone) the first flush was obtained after 24 days.

P florida gave early flushes in treatments T2, T5, T6 i.e. paddy straw alone, sugarcane trash + paddy straw and sugarcane trash + soybean straw,resp , where as it took 26 days on sugarcane trash alone (T1). In treatment T3 it required 25 days for the first picking

Table 3. Days required for first picking from the date of spawning as influenced by various substrates.

Sr. No.	Treatments	No.of days required.						
		P. eous			*P. florida*			
		RI	RII	Mean	RI	RII	Mean	Pooled Mean
T1	Sugarcane trash alone	24	24	24.0	26	26	26.0	25.00
T2	Paddy straw alone	14	16	15.0	23	24	23.5	19.25
T3	Sugarcane trash + cotton stalk	15	15	15.0	25	25	25.0	20.00
T4	Sugarcane trash + wheat straw	18	19	18.5	24	25	24.5	21.50
T5	Sugarcane trash + paddy straw	17	16	16.5	23	24	23.5	20.00
T6	Sugarcane trash + Soybean straw	18	19	18.5	22	25	23.5	21.00
T7	Sugarcane trash + Soybean meal	21	21	21.0	25	26	25.5	23.20
	Mean			18.4			24.5	

SE for treatment = 0.4

CD at 5% = 1.2

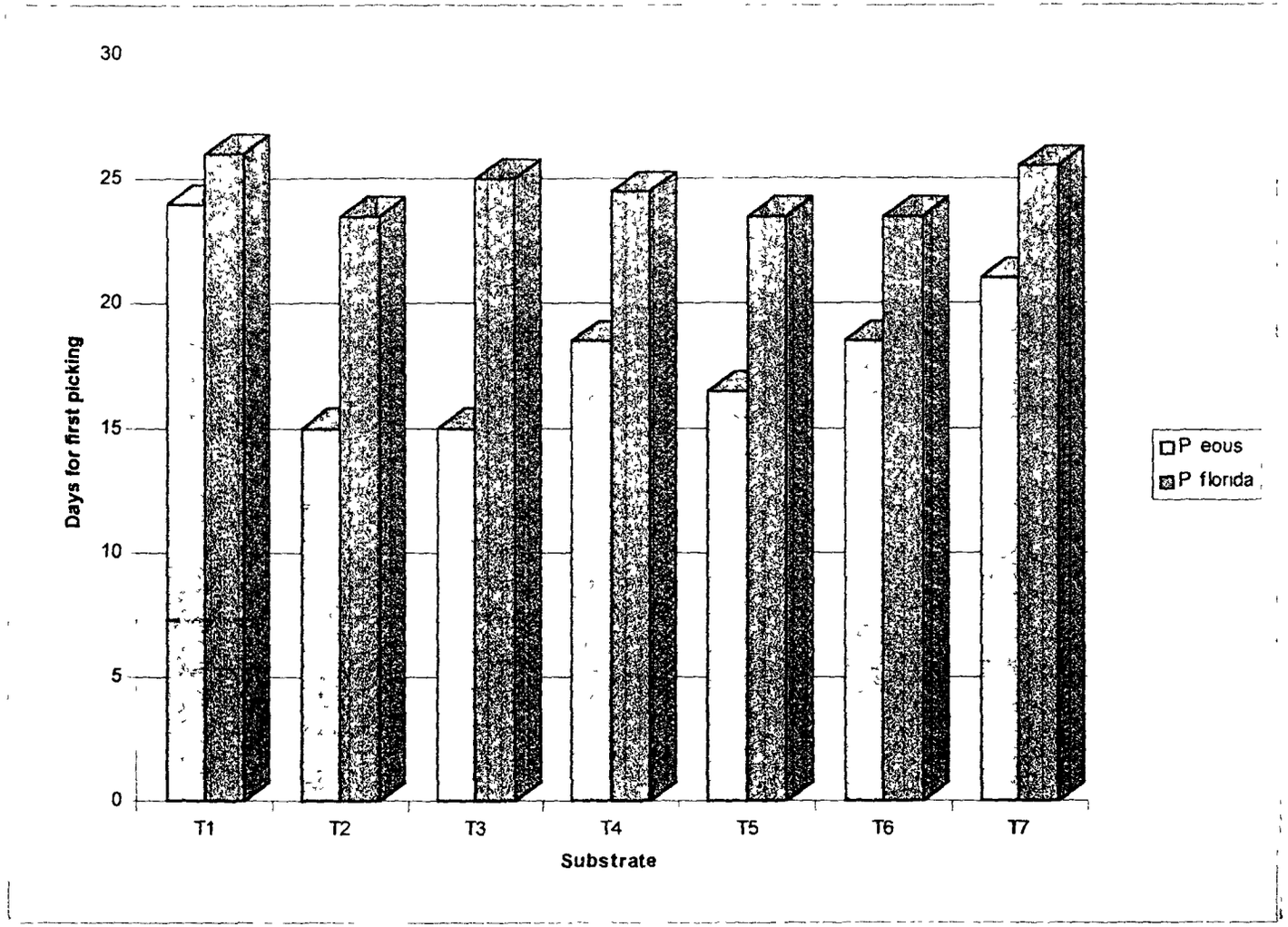
SE for species = 0.21

CD at 5% = 0.64

SE for interaction = 0.56

CD at 5% = 1.693

Fig. 3 Period required for first picking of mushrooms.



First flush was harvested within 20 days in substrates T3 and T5 irrespective of the species, whereas 25 days were required for the same in treatment in T1 It was also observed that treatments T1 and T7 were at par. Similarly T2, T3 and T5, and, T4 and T6 were at par

Prabhu Dessai *et al* (1991) reported that pink mushroom produced pink coloured sporophores within 10-12 days on paddy straw and for *P sajor-caju* the first harvest was obtained within 18-20 days from spawning These durations are 3-4 days shorter than the observations recorded in this experiment which might be due to different weather conditions during the crop growth.

4.4 Effect of different substrates and *Pleurotus spp.* on the total number of sporophores harvested.

The data from Table 4 shows the influence of various substrate and *Pleurotus spp* on the total number of sporophores harvested in the three flushes It was observed that *P eous* produced highest number of sporophores in sugarcane trash alone (T 1) while the least number was found in sugarcane trash + cotton stalk (T3) It was also observed that the number of sporophores of *P eous* in T1, T2 and T5 were at par.

P florida produced the highest number of sporophores in paddy straw alone (T2) and the least in sugarcane trash alone (T1) The number of sporophores in treatments T3 and T5 were found to be at par. Similarly treatments T1 and T7 were at par

When substrates were considered irrespective of *Pleurotus* spp ,maximum number of sporophores were harvested in paddy straw alone (138 75) Treatments T1, T3, T4 and T7 were found to be at par. It was also observed that *P eous* produced significantly higher number of sporophores than *P. florida* in all the treatments

Table 4. Total number of sporophores harvested in three flushes

Sr. No.	Treatments	No. of sporophores.						
		P. eous			*P. florida*			
		RI	RII	Mean	RI	RII	Mean	Pooled Mean
T1	Sugarcane trash alone	161	152	156.5	62	56	59.0	107.75
T2	Paddy straw alone	142	151	146.5	134	128	131.0	138.75
T3	Sugarcane trash + cotton stalk	102	98	100.0	110	97	103.5	101.50
T4	Sugarcane trash + wheat straw	116	125	120.5	86	91	88.5	104.50
T5	Sugarcane trash + paddy straw	156	134	145.5	115	105	110.5	128.00
T6	Sugarcane trash + Soybean straw	172	164	168.0	84	72	78.0	123.00
T7	Sugarcane trash + Soybean meal	137	126	131.5	73	68	70.5	101.00
Mean				138.3			91.5	

SE for treatment = 3.512

CD at 5% = 10.62

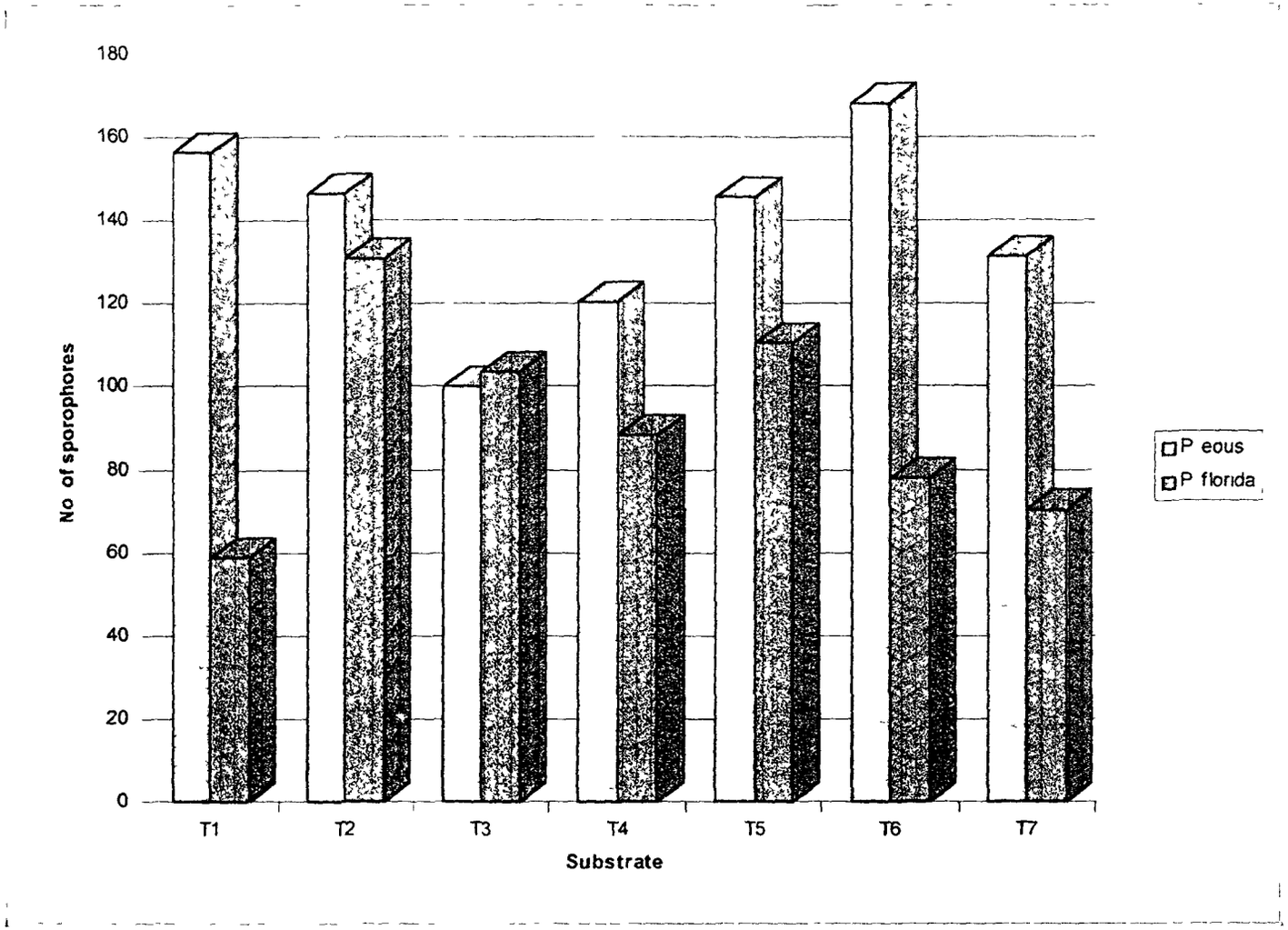
SE for species = 1 877

CD at 5% = 5.67

SE for interaction = 4 96

CD at 5% =15 01

Fig. 4 Total number of sporophores harvested.



4.5 The yield performance of the *Pleurotus* species as influenced by different substrates.

The total yield of oyster mushroom harvested in three flushes /kg of dry substrate is reported in Table 5. The yield potential of *P eous* and *P florida* revealed that *P eous* could produce the highest yield in treatment T5 (657 5 g/kg dry straw), where as it gave the least yield in treatment T4 (462g/kg dry straw). It was observed that yield in T1 (sugarcane trash alone) was at par with treatment T3 and T6 i.e sugarcane trash + cotton stalk and sugarcane trash + soybean straw respectively. On the other hand *Pleurotus florida* recorded the highest yield in treatment T2 i e. paddy straw alone (806 g/kg dry straw) Thus a significant interaction was observed between different species and the substrates Sugarcane trash + paddy straw recorded the highest yield of 698.15 g/kg dry substrate, while the least yield of 446.75 g/kg dry substrate was obtained in sugarcane trash alone irrespective of species. Treatment T1 was found to be at par with T4, T6 and T7

In general it would be observed that the mushroom yields of *P florida* was significantly higher than *P eous* A positive correlation coefficient of + 0 785 for *Pleurotus eous* was observed between mushroom yield and water holding capacity of the substrates Cotton stalks, soybean straw and soybean meal could not enhance the mushroom yield in combination with sugarcane trash.

Prabhu Dessai *et al* (1991) reported that pink *Pleurotus* yielded 881.5 g /kg dry straw of paddy Similarly, mushroom yield of *P florida* on paddy straw in the range of 500 to 900 g/kg dry substrate have been reported by Diwakar (1990), Chander Rao

Table 5. Yield of fresh oysters mushroom (g/kg of dry substrates)

Sr. No.	Treatments	Yield in g/kg dry substrate.						
		P. eous			P. florida			
		RI	RII	Mean	RI	RII	Mean	Pooled Mean
T1	Sugarcane trash alone	524.0	478.0	501.0	422.5	362.5	392.5	446.7
T2	Paddy straw alone	574.0	606.0	590.0	825.0	787.5	806.3	698.1
T3	Sugarcane trash + cotton stalk	532.4	480.0	506.3	675.0	620.0	647.5	576.9
T4	Sugarcane trash + wheat straw	447.0	477.0	462.0	480.0	497.5	488.8	475.4
T5	Sugarcane trash + paddy straw	687.5	627.5	657.5	761.3	732.5	746.9	702.2
T6	Sugarcane trash + Soybean straw	542.0	512.5	527.3	440.0	410.0	425.0	476.1
T7	Sugarcane trash + Soybean meal	477.5	457.5	467.5	440.0	426.2	433.1	450.3
Mean				530.2			562.2	

SE for treatment = 10.77

CD at 5% = 32.66

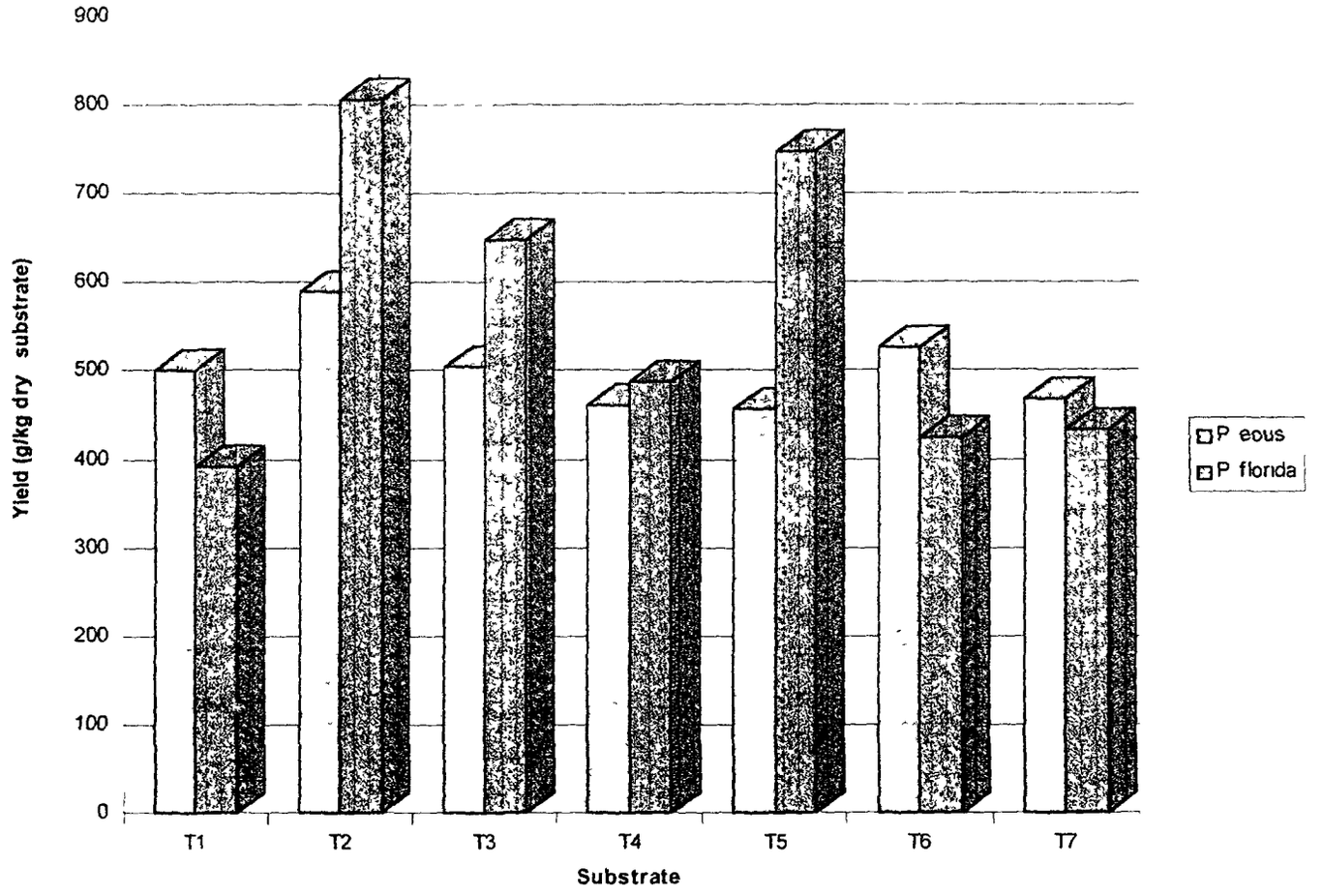
SE for species = 5.75

CD at 5% = 17.46

SE for interaction = 15.23

CD at 5% = 46.19

Fig. 5 Yield performance of *Pleurotus* spp. in the different substrates.



(1991), Kumar and Shukla (1995) The wide yield range could probably be due to varied weather conditions

Patil and Jadhav (1991) reported the yield of *P sajor-caju* on paddy straw alone and sugarcane trash alone to be 965 g/kg dry straw and 305 g/kg dry substrate respectively The yield levels reported in the present study are in accordance with the observations recorded by the earlier workers

4.6 The water holding capacity of the substrate

It could be seen from the data given in Table 6 that the water holding capacity of paddy straw was the highest (320%) followed by the combination of sugarcane trash + paddy straw (285 %) The least water holding capacity was observed in case of sugarcane trash when used alone i.e. 130 per cent

There was direct correlation between the water holding capacity of the substrate and the mushroom yield hence paddy straw in combination with sugarcane trash resulted into good water holding capacity and the mushroom yield.

4.7 Correlation between the water holding capacity of the substrate and yield of mushroom grown on them.

The data in Table 7 shows the correlation between the water holding capacity of the substrate and the corresponding yield of the oyster mushroom on the substrate The coefficient of correlation (r) for *Pleurotus eous* was found out to be +0.6924 and that for *Pleurotus florida* was +0 785. Thus it was evident that there is a positive correlation

Table 6. Per cent water holding capacity of the subtrate utilised for growing oyster mushroom

Sr. No.	Treatment/ substrate	Weight (g) of substrate		Water holding capacity (%)
		before soaking	after soaking	
T1	Sugarcane trash alone	100	230	130
T2	Paddy straw alone	100	420	320
T3	Sugarcane trash + cotton stalk	100	263	163
T4	Sugarcane trash + wheat straw	100	340	240
T5	Sugarcane trash + paddy straw	100	385	285
T6	Sugarcane trash + Soybean straw	100	302	202
T7	Sugarcane trash + Soybean meal	100	235	135

SE for treatments = 3.98
CD at 5% = 12.24

The figures in above Table are the mean of three replications.

Table 7. Correlation betweeen water holding capacity and mushroom yield.

Sr. No.	Treatment/ substrate	Water holding capacity (%)	Yield(g) of *Pleurotus* spp.	
			P. eous	*P. florida*
T1	Sugarcane trash alone	130	501.00	392.50
T7	Sugarcane trash + Soybean meal	135	467.50	433.12
T3	Sugarcane trash + cotton stalk	163	506.25	647.50
T6	Sugarcane trash + Soybean straw	202	527.25	425.00
T4	Sugarcane trash + wheat straw	240	462.00	488.74
T5	Sugarcane trash + paddy straw	285	657.50	746.87
T2	Paddy straw alone	320	590.00	806.25
			r= +0.6924	r= +0.785.

Fig. 6 Linear correlation between % water holding capacity of substrate and yield of *Pleurotus eous.*

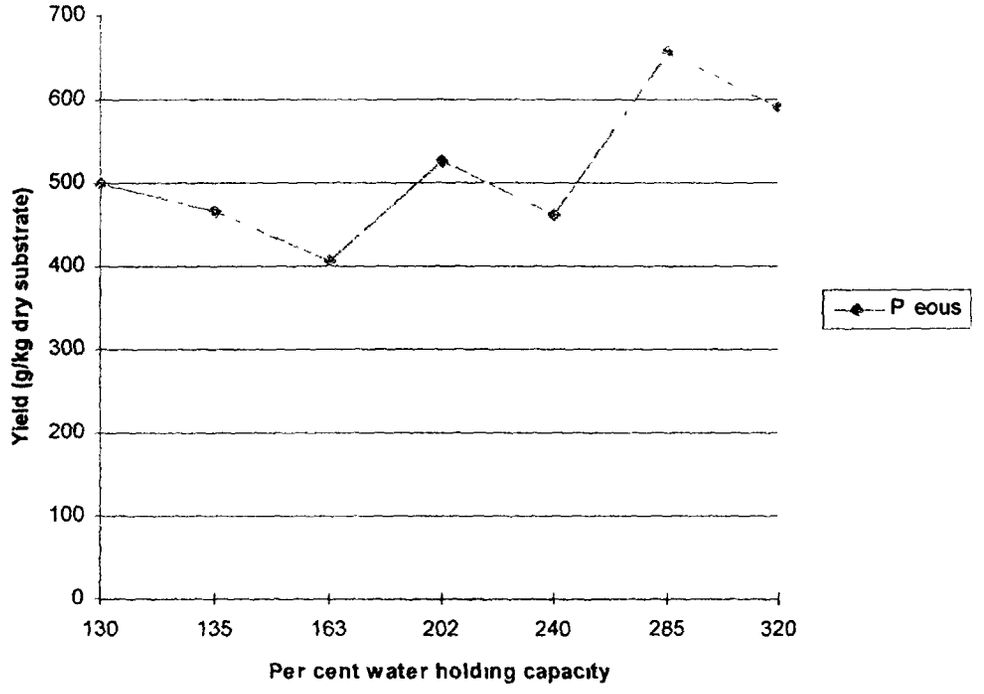
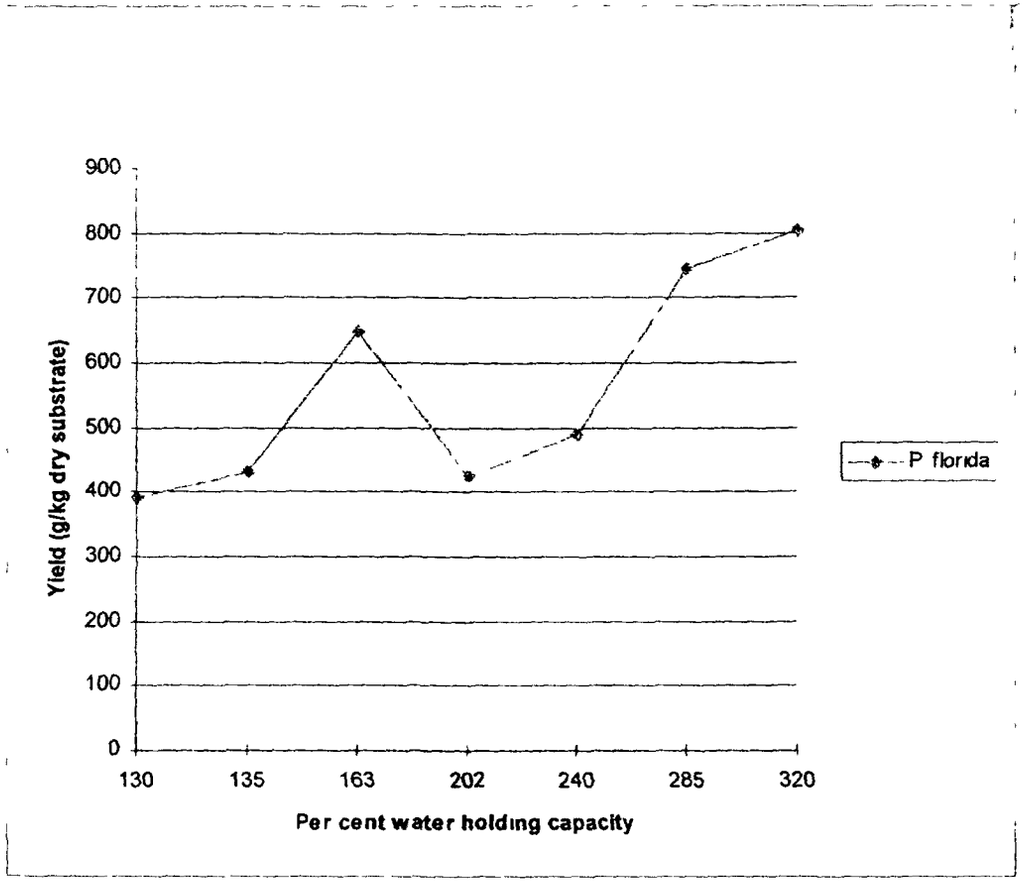


Fig. 7 Linear correlation between % water holding capacity of substrate and yield of *Pleurotus florida*.



between the water holding capacity of the substrates and yield of the oyster mushroom on them.

It could be concluded that *P eous* is having more stress tolerance to the substrate moisture than *P florida.* The paddy straw having the highest water holding capcity of 320 did provide excess moisture for the growth of *P eous* but when combined with sugercane trash supplied it's optimum moisture requirement,thus resulting into to a better yield performance However *P. florida* could grow better at considerably higher moisture level than the optimum level for *Pleurotus spp.* in general.

4.8 Changes in total nitrogen content in the spent substrate.

From the data presented in Table 8 it would be observed that percent total nitrogen increased from initial level in all the treatments. In the treatments in which *Pleurotus eous* was grown, T2 showed highest gain of nitrogen (+1 27%) over initial straw where as T1 showed least gain of nitrogen in (+0 95%) On the other hand *Pleurotus florida* showed highest gain of nitrogen in T5 (+1 37%) and the least in T1 (+0 83%). It could be observed that *P eous* and *P. florida* to be at part. The gain in percent Nitrogen content was founf to be maximum in substrate T5 (+1 3%) and minimum in T1 (+0 89%) irrespective of species

Zheng *et al* 1988 reported the presence of Nitrogen fixing organisms in the straw on which *Agaricus bitorquis, Volvariella volvacaea* or *Pleurotus spp* were grown Growth of the Nitrogen fixing organisms and Nitrogen fixation were increased in the presence of the fungi These observations are in confirmity with the results of Jadhav (1995),

Table 8. % Total per cent Nitrogen content of spent straw

Sr. No.	Treatments	Nitrogen per centage							
		Pleurotus eous				Pleurotus florida			
		Initial	RI	RII	Mean	RI	RII	Mean	Pooled Mean
T1	Sugarcane trash alone	0.42	1.38	1.36	1.37	1.26	1.25	1.25	1.31
T2	Paddy straw alone	0.71	2.00	1.96	1.98	2.05	2.0	2.03	2.00
T3	Sugarcane trash + cotton stalk	0.64	1.72	1.69	1.70	1.78	1.75	1.76	1.73
T4	Sugarcane trash + wheat straw	0.47	1.47	1.48	1.47	1.56	1.58	1.57	1.52
T5	Sugarcane trash + paddy straw	0.56	1.78	1.82	1.80	1.96	1.91	1.93	1.86
T6	Sugarcane trash + Soybean straw	0.63	1.86	1.82	1.84	1.61	1.58	1.59	1.71
T7	Sugarcane trash + Soybean meal	0.67	1.80	1.78	1.79	1.73	1.72	1.72	1.75
Mean		0.58			1.70			1.69	

SE for treatments = 0.098

CD at 5% = 0.29

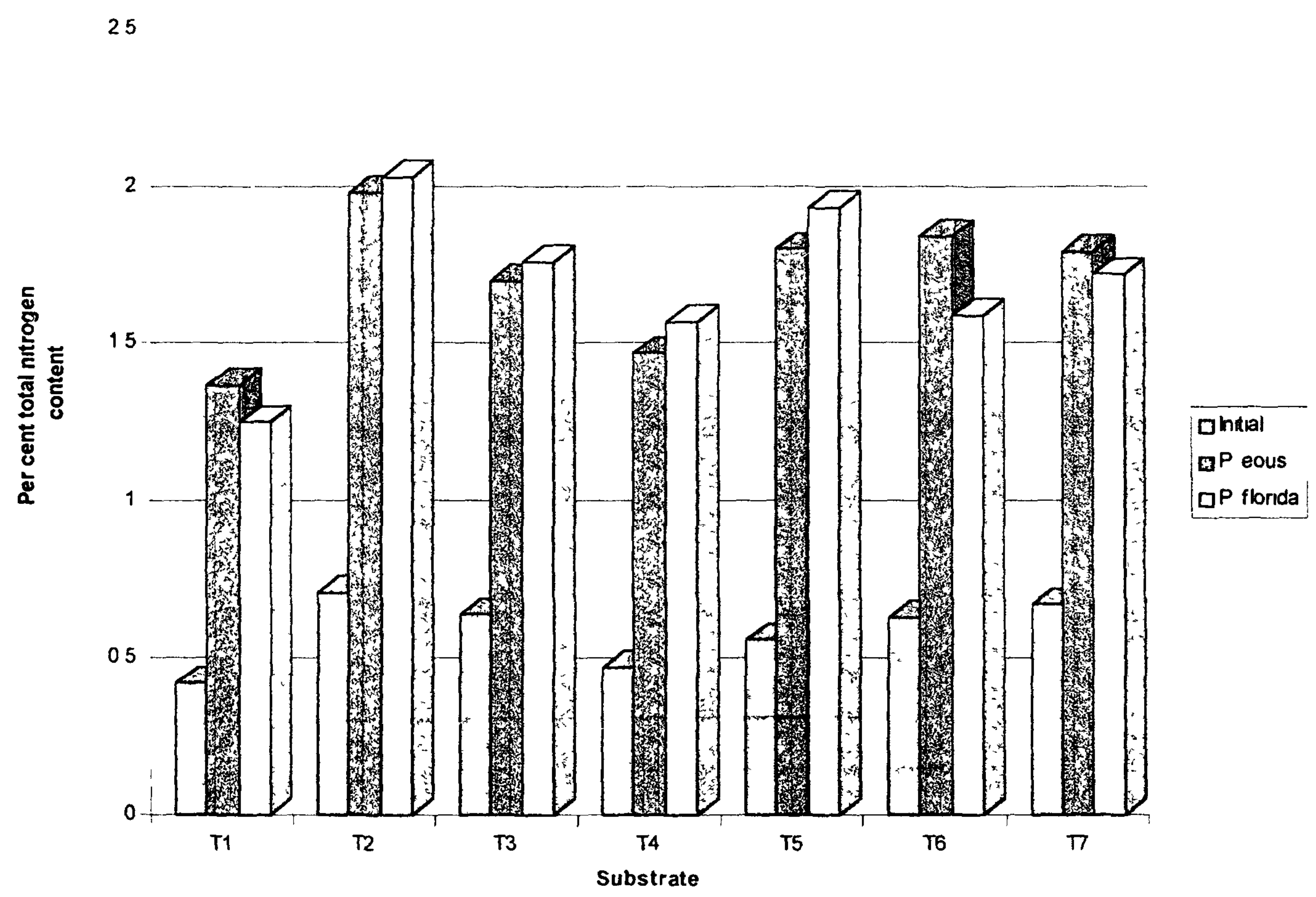
SE for species = 0.052

CD at 5% = 0.15

SE for interaction = 0.139

CD at 5% = 0.422

Fig. 8 Changes in Nitrogen content of the substrate due to cultivation of oyster mushroom.



and Rangaswamy *et al* (1975) who reported increase of protein content of the spent substratum

4.9 Changes in organic carbon content of substrates

From the data presented in Table 9 it may be observed that there is decrease in organic cabon content in all the substrates used for growing oyster mushroom In case of *Pleurotus eous* maximum loss of organic carbon was observed in treatment T2 (-4 17%) and minimum loss in sugarcane trash i.e.T1 (-2.42%) Similarly in case of *Pleurotus florida* maximum loss of carbon was observed in paddy straw T2 (-4 41%), while minimum loss was observed in T1 i e sugarcane trash alone (-2 297%) Maximum loss of organic Carbon was found in the spent substrate of T2 (-4.3 %) and minimum in T1 (-2.36%) irrespective of species grown

The loss of organic carbon may be due to the utilization of carbon from hemicellulose and cellulose content of the substrate Amanat *et al* (1987) observed *Pleurotus ostreatus* in wheat and rice showed reduced content of hemicellulose from 25 10% to 16.28% in wheat and 15.36% at 8.47% in rice straw.

Similarly Jadhav (1995) reported reduction of organic carbon content of spent straw upto 66.8%. According to Prabhu Dessia and Shivappa Shetty (1991) the loss of Carbon is due to carbon dioxide released during respiration As a result of which there is a proportionate increase of nitrogen content

Table 9. Change in organic carbon content of spent substrate

Sr. No.	Treatments	Organic carbon percentage							
			Pleurotus eous			Pleurotus florida			Pooled
		Initial	RI	RII	Mean	RI	RII	Mean	Mean
T1	Sugarcane trash alone	49.88	47.43	47.49	47.46	47.56	47.62	47.59	47.52
T2	Paddy straw alone	42.36	38.16	38.12	38.18	37.90	38.00	37.95	38.06
T3	Sugarcane trash + cotton stalk	46.32	42.94	43.01	42.07	42.82	42.88	42.85	42.46
T4	Sugarcane trash + wheat straw	48.00	45.37	45.33	45.35	45.29	45.21	45.25	45.30
T5	Sugarcane trash + paddy straw	45.92	43.73	42.81	43.27	42.63	42.70	42.66	42.96
T6	Sugarcane trash + Soybean straw	41.90	38.54	38.62	38.58	38.39	38.47	38.43	38.50
T7	Sugarcane trash + Soybean meal	46.70	42.82	42.91	42.86	42.82	42.89	42.86	42.86
Mean		45.86			42.66			42.50	

SE for treatments = 0.018

CD at 5% = 0.056

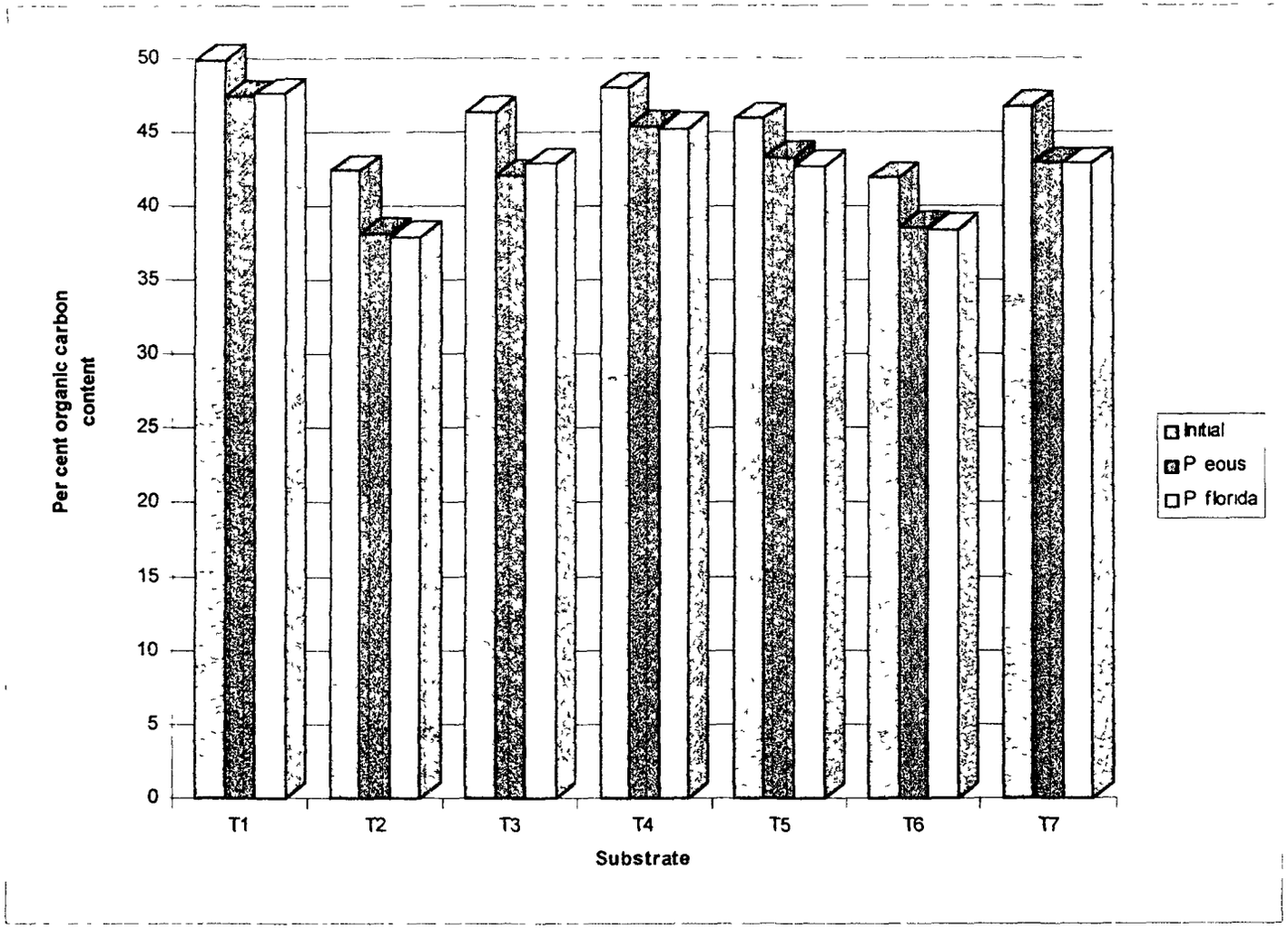
SE for species = 0.01

CD at 5% = 0.03

SE for interaction = 0.026

CD at 5% = 0.08

Fig. 9 Changes in Organic carbon percentage of the substrate due to cultivation of oyster mushroom.



4.10 Changes in C : N ratio of substrates

From the data presented in Table 10 it would be observed that the C N ratio of the spent substrate decresed with the increase in total nitrogen content The lowest C N ratio was observed in treatment T2 i.e. paddy straw for both the mushroom species grown, where as the widest C N ratio was observed in treatment T1 i e. sugarcane trash Another spent substrate with wide C: N ratio was T4 while T6 had narrow C·N ratio for *P eous* T5 (Sugarcane trash + paddy straw) showed narrow C N ratio when *P florida* was grown on it Jadhav (1995) reported similar reduction of C N ratio upto 20 51% Though there was a significant difference in C : N ratio due to two *Pleurotus* species magnitude of it was very very small

Table 10. Changes in C : N ratio of substrate

Sr. No.	Treatments	C:N. ratio						
			Pleurotus eous			Pleurotus florida			
		Initial	RI	RII	Mean	RI	RII	Mean	Pooled Mean
T1	Sugarcane trash alone	118.76	34.36	34.91	34.63	37.74	38 09	37.91	36.27
T2	Paddy straw alone	59.66	19.08	19.49	19.28	18.48	18.81	18.64	18.96
T3	Sugarcane trash + cotton stalk	72.37	24.96	25.44	25.20	24.05	24.50	24.27	24.73
T4	Sugarcane trash + wheat straw	102.12	30.86	30.62	30.74	29.03	28.61	28.82	29.78
T5	Sugarcane trash + paddy straw	82.00	24.56	23.52	24.04	21.75	22.35	22.05	23.04
T6	Sugarcane trash + Soybean straw	66.50	20.72	21.21	20.96	23.84	24 34	24.09	22.52
T7	Sugarcane trash + Soybean meal	69.70	23.78	24.10	23.94	24.75	24.93	24.84	24.39
Mean		**81.58**			**25.54**			**25.80**	

SE for treatments = 0.158

CD at 5% = 0.478

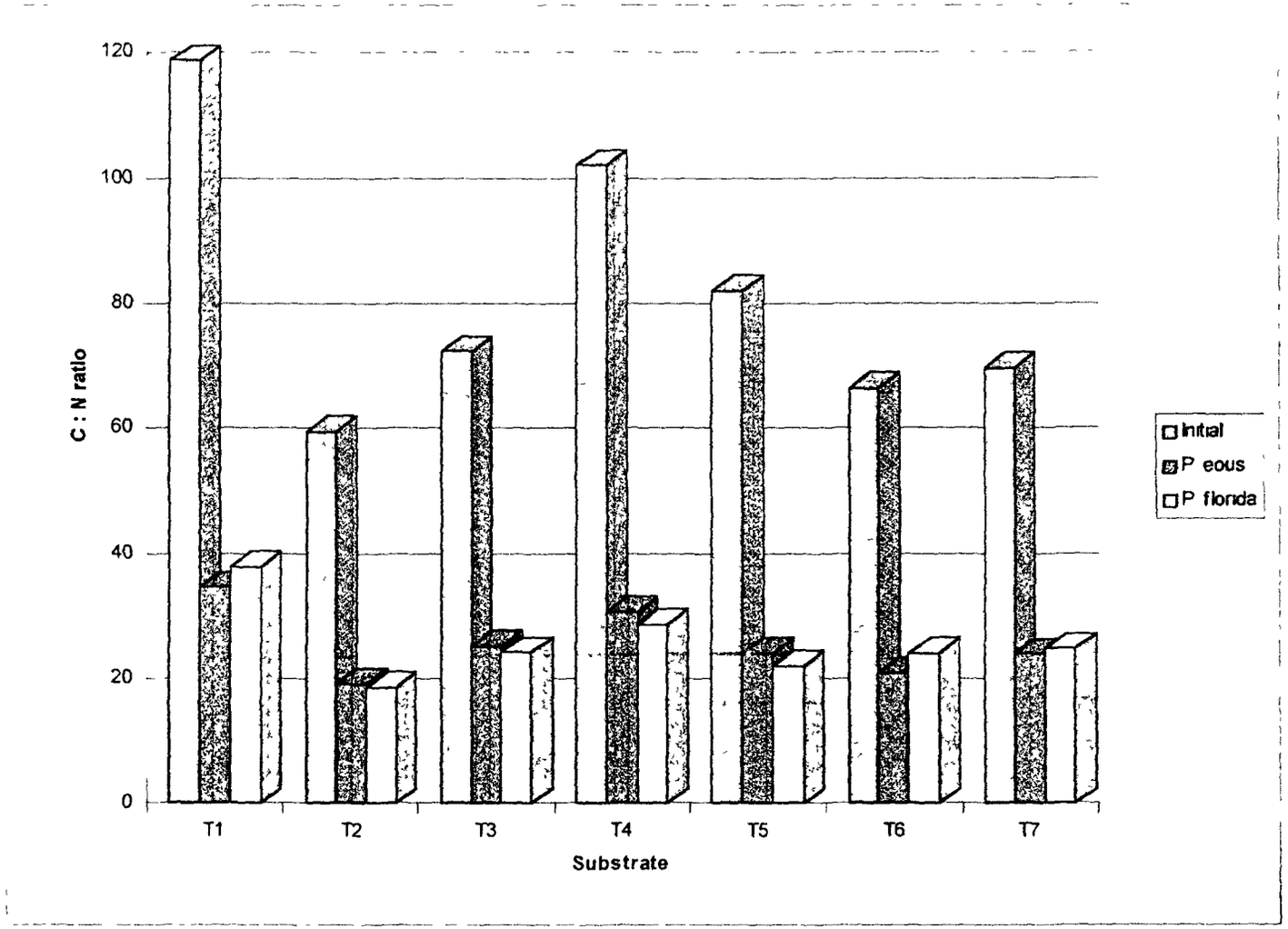
SE for species = 0.084

CD at 5% = 0.255

SE for interaction = 0.223

CD at 5% = 0.676

Fig. 10 Changes in C : N ratio of substrate due to cultivation of oyster mushroom .



SUMMARY AND CONCLUSION

5. SUMMARY AND CONCLUSION

The study was undertaken to find out the suitability of sugarcane trash as a substrate for growing two species of oyster mushrooms viz ,*Pleurotus eous* and *Pleurotus florida*

The observations on completion of spawn run and days required for first picking indicated that the *P eous* is fast growing species resulting into early picking than *P florida*. *P eous* and *P florida* required 10 35 and 14.78 days respectively for completion of spawn run, whereas 18 35 and 24 5 days respectively are required for first picking from the day of spawning. In other words *P eous* took 4 43 days less for complete spawn run than *P florida* and gave first flush earlier by 6 15 days

The observations regarding the yield of both the species on different substrates revealed that, the yield of *P eous* was significantly higher in 1 1 combination of sugarcane trash with paddy straw (657.5 g/kg dry substrate) than all other treatments, the least being in sugarcane trash + wheat straw (462 g/kg substrate) *P florida* gave the maximum yield in paddy straw alone (806 g/kg dry straw) followed by the combination of sugarcane trash + paddy straw (746 4 g/kg dry substrate) It gave significantly low yield in sugarcane trash (392.5 g/kg dry substrate)

It was also observed that both the mushrooms gave different response on different substrates This behaviour could be attributed to the moisture holding capacity of the substrates and the stress tolerance capacity of the mushroom spp. It was quite evident that the combination of sugarcane trash + paddy straw proved to improve the productivity of sugarcane trash due to high moisture retention capacity of paddy straw

Another objective of the investigation was to compare the yield potential of pink mushroom (*Pleurotus eous*) with that of a recommended species like *Pleurotus florida* It was observed that *P eous* gave significantly higher yield in treaments T1 (sugarcane trash alone), T6 (sugarcane trash + soybean straw) and T7 (sugarcane trash + soybean meal) than *P florida* While *P florida* recorded significantly higher yield in rest of the treatments viz , T2 (paddy straw alone), T3 (sugarcane trash + cotton stalk), T4 (sugarcane trash + wheat straw) and T5 (sugarcane trash + paddy straw) as given in Table 5

From the chemical analysis of the spent substrate it was observed that organic carbon decreased, whereas percent Nitrogen content increased which led to decrease in C·N ratio in all the treatments.

For *P eous* the organic carbon was minimum in paddy straw alone (38 18%) and maximum in sugarcane trash alone (47 46%) The Total nitrogen content was maximum in paddy straw (1.98%) and minimum in sugarcane trash alone (1 37%) whereas the C:N ratio was the widest in sugarcane trash alone (34 63) and the least in paddy straw (19.28). In the other treatment, it ranged in between two treatments i e T1 and T2

Similar trends were also observed in respect of *P florida* The organic carbon was least in paddy straw (37 95%) and maximum in sugarcane trash (47 59%) The total nitrogen content was maximum in paddy straw (2 03%) and minimum in sugarcane trash (1 25%) and the C N ratio was the widest in sugarcane trash (37 91) and the narrowest in paddy straw (18.64).

It could be summerized that sugarcane trash can be successfully used as a substrate for growing *P eous* and *P florida* specifically in combination with substrates having high water holding capacity

Pleurotus eous could grow better on substrates having lower water holding capacity, however, further in depth studies would require to confirm the observations recorded during the present investigation.

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6. LITERATURE CITED

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