

RESEARCH ARTICLE :

Potentiality of a new mushroom fungus *Lentinus connatus* Berk on biodegradation of various agro-industrial wastes on the incidence of sheath blight of rice

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SUMMARY : *L. connatus* treated coir waste and urea at all levels significantly reduced the intensity of sheath blight, when compared with *P. sajor-caju*. The treatments coir waste compost (*L. connatus*) @ 18.5 t + urea @ 60 kg N/ha and composted coir waste (*L. connatus*) @ 15.5 t/ha + urea @ 60 kg N / ha were found superior and significantly reduced the intensity of sheath blight (Gr. 3.00 and 3.52), compared to the existing fertilizer recommendation of 12.5t composted + 120 kg N/ha, where maximum disease intensity of Gr. 9.75 (sheath blight). The similar trend was also observed with *P. sajor - caju*. The above said best treatments also significantly reduced the disease intensity of sheath blight (Gr. 5.60 and 6.20). The earlier treatments not significantly reduced the disease intensity and on par with existing recommendation.

KEY WORDS:

L. connatus, *P. sajor-caju*, Coir waste, Urea, Phosphorus, Potassium, *Rhizoctonia solani*

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BACKGROUND AND OBJECTIVES

In India, vast quantities of renewable agro and agro-industrial wastes are generated every year (Madan *et al.*, 1987). More than half of the total produce from the land remains unused as wastes (Zadrazil, 1984). The abundant availability of these crop residues, the problems associated with its disposal, the associated environmental pollution problem and the physio-chemical characteristics of these materials attracted the attention of

technologists in finding productive use of these crop residues.

The current boom in inorganic fertilizer prices and low availability of organic manures, limit the use of these viable source of nutrients in agriculture. There have been many reports of studies on the bioconversion of lignocellulosic materials into a potential biomanure (Anderson *et al.*, 1971; Zadrazil, 1975 and Beg *et al.*, 1986).

Efficient degradation of complex

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lignocellulosic wastes by *Pleurotus* spp. largely depends upon the synergistic action of extracellular enzymes like cellulases and lignases. These enzymes have been reported to narrow down the C: N ratio in various organic residues, indicating the better rate of lignocellulosic degradation (Sheeba *et al.*, 1999 and Singh and Griensven, 2000). Hence, soil application of such a degraded crop residues improves the nutritional status of the soil and suppresses soil borne pathogens (Rajan, 1980 and Sheela, 1992).

In a search for an efficient biodegrader for the production of high quality biomanure, the present study was undertaken to probe the potentially of a new mushroom fungus *viz.*, *Lentinus connatus* Berk., isolated from the dead woods of cashew (Lakshmanan, 2002), on comparison with existing biodegrader. Abundant availability organic wastes pose problem of disposal. Bio-conversion of these renewable wastes would solve pollution problems and also the organic wastes become available for soil enrichment.

Bio-degradation of various agro and agro-industrial wastes could be accomplished through several micro organisms to degrade lignocellulosic complex. Among the microbes mushroom fungi were known to produce lignocellulolytic enzymes to degrade cellulose and lignin. Hence, biological pretreatment of lignocellulosic wastes with mushroom fungi might become economically and environmentally attractive. In a search for an efficient biodegrader for the production of potential manure, a detailed research was undertaken.

RESOURCES AND METHODS

Preparation of substrates for composting :

The substrates *viz.*, paddy straw, sugarcane trash and sugarcane bagasse were chopped off 5 to 10 cm length. The substrate coir waste was used without



chopping. They were solar dried for 5 - 6h. Enough water was added to make it sufficiently moist (40 - 50%). The moisture held in substrate was calculated by gravity method (Piper, 1966).

Method of composting:

Heap method of composting described by Manickam *et al.*, 1980) was followed. For composting 20 kg of moist substrate, 20 g fungal culture (*L. connatus* / *P. sajor caju*) and 100 g urea were used. Two kg of substrate was spread uniformly (75 x 45 cm) in a shaded place and 4 g of fungal culture (*L. connatus* / *P. sajor caju*) was sprinkled over it. This was to be alternated with 2 kg of substrate and 20 g of urea. The alternate layers of substrate + culture and substrate + urea were stacked upto the height of 1m. Substrate only with *L. connatus* / *P. sajor-caju* were also maintained for comparison. The heap was allowed to degrade for a month. For each substrate / Commonly grown rice cultivar ADT - 36, was sown in peat trays (10x20x40 cm). Four weeks after germination, the seedlings were transplanted to 10cm dia earthen clay pots filled with 4 kg of clay soil @ 3 seedlings per pot. Before transplanting, 50% of the total inorganic nitrogen and 100% of the total P_2O_5 , K_2O and coir waste composted by *L. connatus* / *P. sajor-caju*, were applied at basal separately. On 45th and 60th day after transplanting, the remaining 50% of total inorganic nitrogen was applied in two split doses. Three replicated pots for each fertilizer dose / composted coir waste (*L. connatus* / *P. sajor-caju*), were maintained in a Randomized Complete Block Design.

Treatments details :

Fertilizer dose (ha)

- T₁: 12.5 t compost + 120 kg N + 38 kg P_2O_5 + 38 kg K_2O
- T₂: 12.5 t compost + 90 kg N + 38 kg P_2O_5 + 38 kg K_2O
- T₃: 12.5 t compost + 60 kg N + 38 kg P_2O_5 + 38 kg K_2O
- T₄: 15.5 t compost + 90 kg N + 38 kg P_2O_5 + 38 kg K_2O
- T₅: 15.5 t compost + 60 kg N + 38 kg P_2O_5 + 38 kg K_2O
- T₆: 18.5 t compost + 90 kg N + 38 kg P_2O_5 + 38 kg K_2O
- T₇: 18.5 t compost + 60kg N + 38 kg P_2O_5 + 38 kg K_2O .

Artificial inoculation of fungal pathogens:

Inoculum production :

Preparation of rice grain inoculum:

A rice grain mixture (cv.ADT 36) consisting of 2/3 filled grains and 1/3 chaffy grains and weighing 30 g in a 100 ml Erlenmeyer flask, after overnight presoaking in fresh water. After autoclave sterilization at 151b pressure for 2 h, the flask was inoculated with a 9 mm disc of 10-day-old PDA culture of *R. solani*. They were incubated at 25 ±3°C for 15 days and then used for inoculation (Amin *et al.*, 1974).

Method of inoculation:

Inoculation was done at active tillering phase, for *T. cucumeris*. In case of *T. cucumeris* rice seedlings were artificially inoculated by inserting the single rice grain culture (15 day-old), being placed inside base of the sheath enclosing culm.

Disease intensity :

Individual tillers were assessed at 3 day intervals for fungal disease infection on a 0-9 scale, using Standard Evaluation System For Rice Diseases (Anonymous, 1981).

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

Disease intensity :

In a preliminary observation, a new mushroom fungus isolated from the dead wood of cashew, completely degraded the card board sheet within a week, when gill region kept over for taking spore print. Later, the fungus was identified as *Lentinus conatus*. The potentiality of this fungus on biodegradation of paddy straw, coir waste, sugarcane trash and sugarcane baggase was studied in comparison with biodegrader *Pleurotus sojar — caju*.

The results on the disease intensity of sheath blight due to the application of coir waste composted by *L. connatus*, *P. sajor - caju* and urea, at different levels are presented in Table 1.

Among the mushroom fungi, *L. connatus* treated coir waste and urea at all levels significantly reduced the intensity of sheath blight, when compared with *P.*

Table 1: Efficacy of coir waste compost on the intensity of sheath blight of rice (var. ADT 36)

Sr. No.	Fertilizer doses (ha)	* <i>L. connatus</i>	* <i>P. sajor-caju</i>
		Sheath blight	Sheath blight*
1.	1 2.5 t+ 120 kg N (control)	7.75	8.50
2.	12.5 t + 90 kg N	7.00	7.81
3.	12.5t + 60kgN	6.52	7.50
4.	15.5t + 90kgN	6.48	7.95
5.	15.5t + 60kgN	3.52	6.20
6.	18.5t + 90kgN	6.12	7.92
7.	18.5t + 60kgN	3.00	5.60
C.D. (P = 0.05)		1.74	1.60
			Sheath blight
Species		0.03	
Treatment		0.02	
Species x treatments		0.04	

* Disease intensity on 0-9 scale

sajor- caju. The treatments coir waste compost (*L. connatus*) @ 18.5 t + urea @ 60 kg N/ha and composted coir waste (*L. connatus*) @ 15.5 t/ha + urea @ 60 kg N / ha were found superior and significantly reduced the intensity of sheath blight (Gr. 3.00 and 3.52), compared to the existing fertilizer recommendation of 12.5t composted + 120 kg N/ha, where maximum disease intensity of Gr. 9.75 (sheath blight) .The other treatments were on par with existing recommendation.

The similar trend was also observed with *P. sajor - caju*. The above said best treatments also significantly reduced the disease intensity of sheath blight (Gr. 5.60 and 6.20). The earlier treatments not significantly reduced the disease intensity and on par with existing recommendation (Fig.1).

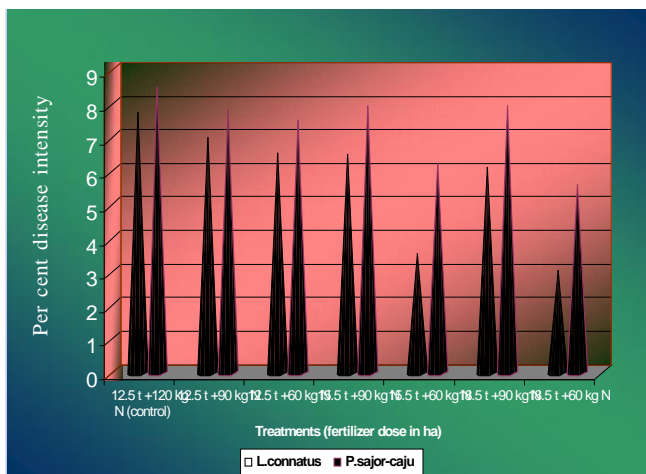


Fig. 1 : Efficacy of coir waste compost on the intensity of sheath blight of rice (var. ADT 36)

It is well known that lignocellulosic crop residues are the most abundant naturally occurring polymers in the biosphere. Fungi are unique among micro-organisms in that they secrete a variety of extracellular enzymes to degrade lignocellulosic materials. Decomposition of lignocellulosic residues is rated as the most important event in the carbon cycle of the earth (Bannett and Faison, 1997). Efficient and controlled degradation of lignocellulosic materials by these fungi lead to a number of processes of great economic importance. *Pleurotus* spp. well known white rot basidiomycotina produce lignocellulolytic enzymes to degrade complex of lignocellulosic residues, make their use as an alternative method presently used to overcome and reduce environmental pollution.

Coir waste compost on rice disease management :

The current inorganic fertilizer prices and low availability of organic manure like farm yard manure, poultry manure etc. and their bulky need, limit the use of these available sources of nutrients in Agriculture. Use of coir waste, which is available in huge quantities, composted with mushroom fungi have been reported to improve the nutritional status of the soil and reduced various plant diseases (Rajan, 1980; Theradimani and Marimuthu 1992 and Sheela, 1992).

Increased in rice yield and significant reduction of major disease of rice by the application of 15.5 or 18.5 t of coir compost (*L. connatus*) and urea at 60 kg N per ha, might be due to low inorganic nitrogen and high organic crop residue supplementation. Increased inorganic nitrogen appears to influence disease potential than inoculum potential and hence, high inorganic nitrogen level leads to the out break of fungal disease (Baker and Martinson, 1970). Conversely, organic residues at high level decrease disease intensity, even though the population of the pathogen is very high (Nash and Synder, 1962; Huber and Watson, 1974). Moreover, incorporation of coir waste composted by *L. connatus* which contained high amount of minerals might also an important role in the reduction of diseases intensity and improvement of yield (Agrios, 1997).

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