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EFFECT OF *ALCALIGENS FAECALIS* SUPPLEMENTATION TO DIFFERENT CASING MIXTURES ON ITS PHYSICO-CHEMICAL PROPERTIES AND YIELD STIMULATION OF *AGARICUS BISPORUS*

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ABSTRACT

Experiment was conducted to study physico-chemical properties *viz.,* bulk density, pH and electrical conductivity (E.C) and yield performance of *Agaricus bisporus* using different casing materials like Farm yard manure (FYM), spent compost (SC) and coir pith (CP) supplemented with bacterial culture of *Alcaligens faecalis*. It was found that bulk density of casing mixture ranges from 0.61 to 0.72 gm/cm^{3}and was slightly increased with supplementation of bacterium in most of the cases except CP+SC+ *A. faecalis*. The pH of casing soils varied from 6.23 to 6.7. The highest E.C (2.08 deci– simen^{-1}) was found in FYM + SC + *A. faecalis* whereas lowest E.C (1.14 deci- simen^{-1}) was observed in CP + SC, however, electrical conductivity was slightly increased with supplementation of bacterium in all the cases. Enhanced yield was obtained from all the four casing by mixing the bacterium *A. faecalis*. The casing soil FYM + SC + *A. faecalis* gave the maximum yield (21.27 kg/Qtl compost).

INTRODUCTION

White button mushroom (*Agaricus bisporus*) cultivation is a highly scientific activity. In India, its cultivation was first started in the hills as it requires low temperature for its growth but growers realized the potential of this crop and started its cultivation in plains in winter season. Button mushroom requires two different substrates to form the fruit bodies, *i.e.,* the compost for nutrition on which it grows vegetatively and the nutrient deficient casing soil in which the physicochemical conditions stimulate the initiation process of pin head formation for fruit body production (Sanchez, 2004). Casing preparation and application is considered as one of the most important phase in button mushroom production.

Casing is a top-dressing applied to the spawn-run compost on which the mushrooms eventually form. Casing mixture is prepared using different organic matters of plant origin, microbial origin and soil. Once they are mixed together in different proportions the resultant mixture should have improved physico-chemical properties such as water holding capacity, bulk density, electrical conductivity and pH etc., different from the individual components. This improvement in physico-chemical properties is most likely to affect biological characteristics of the casing mixture which in turn will affect the production and productivity of *A. bisporus*. Microflora present in casing layer considerably influences the growth and morphogenesis of *A. bisporus* production. It supports beneficial microbial populations that release growth stimulating substances, which are reportedly involved in stimulating the initiation of pin heads. Several reports are available on the beneficial effects of casing soil microbes, especially *Pseudomonas putida* and *Alcaligens faecalis,* on *A. bisporus* (Rainey *et al.*, 1990).

Besides the physical, chemical and biological factors which determine the suitability of the casing material for button mushroom production were investigated and documented by various other researchers (Dhar *et al.*, 2003; Hayes, 1981).

In present study different casing materials like Farm yard manure (FYM), spent compost (SC) and coir pith (CP) along with bacterial culture of *A. faecalis* were tested in different combination for their physico-chemical properties and yield performance of *A. bisporus*.

MATERIALS AND METHODS

Four casing mixture viz. , FYM+SC (1:1 v/v), both two year old well rotted + culture of *A. Faecalis,* FYM (two year old) + Spent compost (2 year old), Spent compost (2 year old) + culture of *A. Faecalis,* Spent compost (2 year old), Coir pith + FYM (1:1; v/v) + culture of *A. Faecalis,* Coir pith + FYM (1:1; v/v), Coir pith + culture of *A. Faecalis* and Coir pith were used in the present study. In the treatments where coir pith was used, it was soaked in water for 24 hours before mixing. Physico-chemical properties were determined using methods suggested by various workers for determination of bulk density (Blake, 1965), water holding capacity (Peters, 1965), pH

Table 1: Physiochemical properties of different casing mixtures along with bacterial culture of *Alcaligenes faecalis*

Casing mixture	pH			Water holding capacity (%)			Electrical conductivity (deci-simen^{-1})			Bulk density (g/cm^3)		
	2010-11	2011-12	Average (approx.)	2010-11	2011-12	Average	2010-11	2011-12	Average	2010-11	2011-12	Average (approx.)
FYM + SC + AF	6.25	6.31	6.28	167	168	167.5	2.03	2.13	2.08	0.68	0.65	0.66
FYM + SC	6.23	6.22	6.22	166	165	165.5	2.06	2.05	2.05	0.67	0.63	0.65
SC + AF	6.40	6.50	6.45	164	162	163.0	1.96	1.90	1.93	0.64	0.64	0.64
SC	6.38	6.42	6.40	163	163	163.0	1.87	1.83	1.85	0.62	0.60	0.61
CP + SC + AF	6.50	6.67	6.58	190	187	188.5	1.66	1.59	1.62	0.66	0.65	0.65
CP + SC	6.48	6.53	6.50	193	190	191.5	1.08	1.2	1.14	0.67	0.68	0.67
CP + AF	6.70	6.79	6.74	201	200	200.5	2.01	2.11	2.06	0.71	0.73	0.72
CP	6.69	6.70	6.69	203	201	202.0	2.03	2.02	2.02	0.69	0.68	0.68
CD at 5%	0.017	0.017	0.017	1.73	1.73	2.02	0.017	0.27	0.017	0.017	0.017	0.017

Figures in parenthesis are the transformed angular values; FYM = Farmyard manure, SC = Spent compost, CP = Coir pith, AF = *Alcaligenes faecalis*

Table 2: Effect of different casing mixtures along with bacterial culture of *Alcaligenes faecalis* on yield of button mushroom (*Agaricus bisporus)*

Casing mixture	Av. Yield/qtl. from 30 days of harvesting period			
	No.		Wt. (Kg)	
	2010-11	2011-12	2010-11	2011-12
FYM + SC + AF	1511.11	1648.75	21.27	22.85
FYM + SC	1330.49	1370.25	19.24	19.94
SC + AF	1387.37	1465.25	20.55	21.30
SC	1311.99	1358.75	18.84	19.68
CP + FYM + AF	1300.73	1337.50	18.68	18.60
CP + FYM	1220.37	1246.50	16.67	15.93
CP + culture of *A. Faecalis*	1233.62	1282.50	17.86	16.83
CP	1217.94	1212.50	15.37	15.48
CD at 5%	3.06	2.19	3.80	1.91

FYM = Farmyard manure, SC = Spent compost, CP = Coir pith, AF = *Alcaligenes faecalis*

(Jackson, 1967) and electrical conductivity (Jackson, 1967). The pH of all the casing materials was adjusted to 8.0. Then, all the casing mixtures were treated with 4% formalin solution @500 ml/cubic feet casing and covered with plastic sheet for 72 hours. The compost was prepared by short methods, spawned with the strain Dalta of *A. bisporus* @ 0.7% and spawn run done at 22-25°C. After complete spawn run, the bags were cased uniformly with above casing mixture (4.0 cm thickness). Yield evaluation was done in 10 kg bag with four replications. Two successive crops were grown and observations were recorded for mushroom yield in terms of number and weight of fruit bodies produced for the period of 42 days. The cultivation trials were conducted seasonally at prevailing room temperature (18-25°C) and relative humidity (70-80%).

RESULTS AND DISCUSSION

Bags were completely colonized by mushroom mycelium within 20 days and then covered by different casing materials. The major physico-chemical properties of different casing mixtures are presented in Table 1. The bulk density of casing mixture ranging from 0.61 to 0.72 gm/cm^3. Maximum bulk density was observed in CP + *A. faecalis* (0.72 gm/cm^3) followed by CP (0.68 gm/cm^3) whereas, minimum bulk density was observed in SC. The pH of casing mixture varied from 6.23 to 6.75. Increased EC of 2.08 deci simen^{-1} was found in FYM + SC + *A. faecalis* followed by 2.06 deci simen^{-1} in CP + *A. faecalis*. In contrast, CP + SC had the minimum 1.14 deci simen^{-1} electrical conductivity. Water holding capacity appears directly related to bulk density. These factors are directly affecting microbial build up and yield of *A. bisporus*. Water holding capacity was maximum in CP (202) followed by CP + *A. faecalis* (200.5) while it was minimum in SC (163).

The casing mixture prepared using FYM + SC + along with bacterial culture of *A. faecalis* was found significantly superior than others by producing 21.27 kg and 22.85 kg mushroom per 100 kg compost in first and second crops respectively. Casing mixture prepared from FYM + SC and SC along with bacterial culture of *A. faecalis* were statistically similar in their yield performance in both the crops. Among all the casing mixtures CP and CP + FYM were found inferior.

Finally, on the basis of the yield performance it was concluded that the casing material along with bacterial culture of *A. faecalis* was giving higher yield than the different mixtures without the bacterial culture. Among different casing mixtures FYM + SC along with bacterial culture of *A. faecalis* was found highly effective and it was found performing at par. The bacterial population of casing soil especially *Pseudomonas putida* and *Alcaligens* sp. (Ahlawat and Verma, 1999. Fermor *et al.*, 2000) have been reported to influence the pinning process as well as the total yield in the white button mushroom. Result was found similar to Ahlawat and Rai (2000) who has reported that broth culture of *A. faecalis* resulted in significantly higher yield than the uninoculated treatments. Ahlawat *et al.* (2002) has also reported that mushroom yield was significantly higher in *A. faecalis* inoculated treatment over the uninoculated control without affecting the quality and shelf life of the fruiting bodies, though the differences in yield were found significant

only after 5th week of cropping.

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