The Bioscan 12(1): 349-353, 2017 (Supplement on Agronomy)
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

EVALUATION OF DIFFERENT GRAINS USED FOR PRODUCTION OF SPAWN MATERIAL AND UTILIZATION OF SPAWN MATERIAL FOR CULTIVATION OF *PLEUROTUS* SPP.

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KEYWORDS
Plerotus florida
Pleurotus. eous
Pleurotus sajor-caju
Spawn substrates
Biological efficiency

Received on :
05.09.2016

Accepted on :
11.01.2017

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ABSTRACT
Effect of seed grains *viz*. Sorghum, Wheat, Rice, Maize, Gram, Mung and Garden pea seeds was used for production and cultivation of *Pleurotus* spp. (*P. florida, P. eous, P. sajor-caju*) on rice straw. The minimum days for mycelia run on seed grain was on sorghum grain (9, 8 and 8 days) and maximum number of days on rice grain (17, 18 and 20 days) was noticed in *P. florida, P. eous, P. sajor-caju* respectively. The spawn substrates showed different response on biological efficiency of *Pleurotus* spp. (*P. florida, P. eous, P. sajor-caju*). Maximum biological efficiency of *P. florida* and *P. sajor-caju* was noticed in wheat grain used as spawn substrates (170.3 % and 125.8 % respectively) and in *P. eous* it was noticed on sorghum grain (166.1 %). The minimum biological efficiency of *P. florida, P. eous* and *P. sajor-caju* was noticed on rice grain used as spawn substrate.

INTRODUCTION

Mushrooms are fleshy fruiting bodies (Alexopoulos *et al.,* 1996) that are considered one of the delicious fruits, and are commonly produced worldwide (Madbouly and Al-Hussainy, 1996). They are a rich source of carbohydrates, proteins, vitamins, and minerals (Ananbeh, 2003). Mushrooms grow on decayed organic matters rich in lignin, cellulose and other complicated carbohydrates. Mushrooms grow in the wild; they have been domesticated in most parts of the world to ensure ready availability all year round and to avoid incidences of mushroom poisoning of inexperienced collectors of wild mushrooms.

The major practical steps of mushroom cultivation are: (a) selection of an acceptable mushroom species; (b) secreting a good quality fruiting culture; (c) development of active spawn; (d) preparation of selective substrate/ compost; (e) care of mycelial (spawn) running; (f) management of fruiting/ mushroom development; and (g) harvesting mushrooms carefully (Chang and Chiu, 1992; Chang, 1998).

The spawn and spawn making has been primary concern in mushroom cultivation which is achieved by developing mushroom mycelia on supporting medium under controlled environmental condition. In almost case the supporting matrix is sterilized grain which is preferred due to its bio-chemical properties and practical performance over others (Siddhant *et al*., 2013). Unfortunately ever increasing demand of food grain for human consumption leaves little scope for their use in spawn making. A number of other materials, mostly agricultural wastes can be use to prepare mushroom spawn the type of waste available vary from region to region. As spawn making substrate inoculation is also crucial phase in mushroom growing practices. A number of materials, mostly agricultural wastes, can be used to prepare mushroom spawn (Bilal *et al.,* 2014). The type of waste available varies from region to region. Some of these wastes are chopped rice straw, sawdust, water hyacinth leaves, used tea leaves, cotton stubble and lotus seed husks (Chang, 2009). In most laboratories, cereal grains such as wheat (Elhami *et al*., 2008; Chang, 2009; Stanley, 2010), rye (Chang, 2009), sorghum (Chang, 2009; Stanley, 2010), rice (Oei, 1996), millet (Oei, 1996; Elhami *et al*., 2008; Stanley, 2010) and white maize (Stanley, 2010) are used as mother spawn.

This paper on mushroom cultivation deals with the standardization of the spawning material for commercial spawn production of *Pleurotus* spp.) on various seed grains.

MATERIALS AND METHODS

Spawn preparation

The spawns were prepared using a modified form of the method of spawn preparation outlined by Stamets and Chilton (1983). Seven different seed grains *viz*. wheat grain, rice grain, sorghum grain, maize seed, gram seed, garden pea seed and mung seed were used to evaluvated the spawn production of *P. florida, P. sajor-caju, P. eous*.

Take two kg healthy and cleaned seed grains of wheat grain, rice grain, sorghum grain, maize seed, gram seed, garden pea seed and mung seed were selected for mother spawn preparation and used for further inoculation of different seed gains. These seed grains washed thoroughly with tap water; then soaked overnight in clean water and semi cooked in hot water (80ºC) for 10 minutes. Excess water was drained off and the seed grains were uniformly spread on a clean plastic sheet on a table. Calcium carbonate (8%) was mixed on wet weight basis of the grains. About 250-300 gm quantity of each treated seed grains was filled in 250-300 guage polypropylene bags 8x12 inch^2. These bags were plugged with cotton and sterilized in an autoclave at 121ºC for two hours. After cooling at room temperature, the bags were transferred in a laminar air flow chamber, where they were exposed to UV light for 20 minutes and then inoculated with fresh mycelial bits taken from the previously prepared culture slants. Inoculated bags were incubated in B.O.D. instrument manually fixed at 28 ± 2ºC for 16-18 days in the. The fresh spawn with profuse mycelial growth was used for further experiments on cultivation aspects of *P. florida, P. sajor-caju, P. eous*.

Bag preparation

The dry rice straws substrates were chopped to small pieces (3-5 cm long). The chopped substrate were weighed and then soaked in cold water for 12 hours. After soaking substrates were be taken out and excess of water drained off. After draining excess of water these straws were weighed. These straws were then sterilized in autoclave at 20 Ibs psi for 20 minutes. After autoclaving the straws were cooled down to ambient temperature and used for filling the sterilized polyethene bags (dipped in 2% formalin).

Cultivation steps

The polypropylene bags of the size 35 × 55 cm^2 (100 gauge thickness) was sterilized by dipping in 2% formalin prior to use and lower Corner of the bags was tied with the string so that the bed assumes a round shape after filling the substrates and were filled with sterilized substrates and multilayered spawning @ 2 percent of wet weight of the substrate. The bags was filled up to their 90 percent capacity and mouths will be closed tightly with threads with the help of sterilized needle, about 20-25 minute holes all round the filled bags was made.

A spawned substrate bag was kept in mushroom house where the temperature and humidity were maintained around 20-25ºC (provided by halogen light artificially to maintain it) and ventilation and 80-90 % (by using foggers) respectively with sufficient light provided by bulb and ventilation for 20 days. After completion of spawn run the bags were removed by cutting longitudinally with sharp blade and these beds was kept on bamboo racks/platform at 15-18ºC temperature and 80-90 % relative humidity for cropping (Shenge KB. and Surywanshi A.P., 2014). Pinhead initiation was evident within 3-4 days after removal of poly bags. The beds were maintained up to the harvest of the third flush, which was completed in 35-40 days after sowing. A small layer of substrate was scrapped off from all the side of the beds after each harvest.

Details of observation recorded

Days require for spawn run

This was recorded by counting days from bag filling to completion of spawn run /mycelial growth in bag.

Days require for pinhead initiation

Pinhead initiation of *P. florida, P. sajor-caju, P. eous* was observed by recording the time taken in days from the date of bag filling to pinhead formation.

Number of pinhead/beds

The physical count of the number of pinhead of *P. florida, P. sajor-caju, P. eous* was measured and were taken as pinhead per bed.

Days require matured fruiting bodies

The physical count of the number of matured fruiting bodies of *P. florida, P. sajor-caju, P. eous* was measured and were taken as fruiting bodies number per bed.

Diameter of stipe (cm²)

This was recorded by measuring the diameter of stalk /stipe

Diameter of pileus (cm²)

The fresh pileus was pressed gently on graph paper and area is marked by pencil drawing and the size was determined by its coverage on graph paper.

Average yield of mushroom (g)

In all the experiment, three flushes of matured mushroom were harvested at an approximately one week interval. Harvested mushroom were cleaned, trimmed and fresh weight after each harvest flush was recorded. The mushrooms were weight just after harvesting of each flush. The total fresh yield was recorded by adding the weight of all mushrooms harvested during all flushes.

Average dry weight (g)

They were dried to constant weight at 45°c and dry weight was recorded.

Moisture content

Moisture content was determined by the difference between the accurately weighed sample before and after drying in an oven at 60°c for 6 hours.

Biological efficiency

Biological efficiency of *P. florida, P.sajor-caju, P. eous* was observed through following formulae:

Statistical analysis

$$\text{Biological efficiency (\%)} = \frac{\text{Fresh weight of mushrooms}}{\text{Dry weight of substrate}} \text{x}100$$

The data obtained of all the experiments was subjected to the Statistical analysis. The per cent values were transformed into arcsine vales. The standard error (SE) and critical difference (C.D.) at level P = 0.05 were worked out and result obtained were compared Statistical.

RESULTS AND DISCUSSION

The result of present investigation revealed that in *P. florida, P. eous* and *P. sajor-caju* the number of days required for mycelial run on different seed grain (Table 1) was minimum on sorghum grains (9, 8 and 9 days respectively) followed by wheat grains (10, 9 and 10 days respectively). Maximum number of days

Table 1: Effect of various spawn substrates on days required for different seed substrates for spawn production

Tr.No.	Treatments	Days required* for spawn run for *P.florida*	*P. eous*	*P. sajor-caju*
T_1	Wheat grain	10	09	11
T_2	Rice grain	17	18	20
T_3	Sorghum grain	09	08	08
T_4	Maize seed	11	09	10
T_5	Mung seed	15	19	21
T_6	Gram seed	18	21	22
T_7	Garden pea seed	16	15	14

Table 2: Effect of different spawn substrates on yield of *P.florida*

Tr.No.	Treatment	Av. Days* of spawn run	Av. days * of pinhead initiation	Av. days *of first harvest	Av. weight* of mushroom harvestedg/ bed	No.of harvested mushroom	Yield g/ bed	B.E. (%)
T_1	Wheat grain	12.66	10.66	9.66	67.3	6.3	425.8	170.5
T_2	Rice grain	21.00	12.33	12.33	61.1	4.2	320.6	128.2
T_3	Sorghum grain	13.66	9.00	10.00	65.1	5.9	390.6	156.2
T_4	Maize seed	14.00	12.00	10.66	62.9	5.6	270.6	108.2
T_5	Mung seed	14.33	9.66	12.33	65.3	5.0	372.4	149.0
T_6	Gram seed	14.66	11.00	13.33	63.4	4.5	296.4	118.2
T_7	Garden pea seed	19.00	11.66	13.00	63.3	4.6	290.8	116.5
S.E.	0.47	0.35	0.39	2.14	0.17	5.09	3.36	
C.D. 5%		1.40	1.06	1.18	6.39	0.53	15.18	10.02
C.V.		3.69	4.00	4.19	4.10	4.23	1.84	3.04

Table 3: Effect of different spawn substrates on yield of *P.eous*

Tr.No.	Treatment	Av. Days* of spawn run	Av. days * of pinhead initiation	Av. days *of first harvest	Av. weight* of mushroom harvestedg/ bed	No.of harvested mushroom	Yield g/ bed	B.E. (%)
T_1	Wheat grain	11.33	9.33	8.66	70.0	6.5	415.3	166.1
T_2	Rice grain	22.00	12.00	13.00	57.2	4.0	234.6	93.8
T_3	Sorghum grain	12.33	9.00	8.33	70.3	6.0	386.9	154.6
T_4	Maize seed	14.33	10.00	11.00	59.9	5.4	264.5	105.7
T_5	Mung seed	19.33	10.33	11.33	60.9	4.9	304.3	121.7
T_6	Gram seed	18.33	10.66	11.66	67.6	4.5	307.6	123.0
T_7	Garden pea seed	18.00	12.00	13.66	58.3	4.3	382.6	153.0
S.E.		0.39	0.30	0.39	1.70	0.16	5.26	2.00
C.D. 5%		1.18	0.91	1.18	5.08	0.48	15.65	5.97
C.V.		2.95	3.60	4.39	3.29	3.84	1.96	1.87

Table 4: Effect of different spawn substrates on yield of *P. sajor-caju*

Tr.No.	Treatment	Av. Days* of spawn run	Av. days * of pinhead initiation	Av. days *of first harvest	Av. weight* of mushroom harvestedg/ bed	No.of harvested mushroom	Yield g/ bed	B.E. (%)
T_1	Wheat grain	12.66	10.00	11.33	69.3	5.6	314.6	125.8
T_2	Rice grain	19.00	13.00	13.00	59.2	3.8	227.6	91.04
T_3	Sorghum grain	14.66	9.00	9.33	66.3	4.9	398.2	159.4
T_4	Maize seed	16.66	10.33	12.00	64.6	4.4	312.6	125.0
T_5	Mung seed	18.00	10.66	11.66	61.3	4.5	305.5	122.2
T_6	Gram seed	18.33	11.66	14.66	64.1	4.8	270.6	108.2
T_7	Garden pea seed	16.66	12.66	14.00	60.9	4.8	304.3	121.7
S.E.		0.39	0.35	1.96	0.14	5.19	2.25	2.00
C.D. 5%		1.18	1.06	1.06	5.84	0.43	15.46	6.72
C.V.		2.94	3.95	3.55	3.77	3.70	2.08	2.27

*Mean of three replications, Bed :- 2.5 kg dry substrate. Av:- Average

Figure 1: Mycelia growth on seed grains of *Pleurotus spp.* (*P. florida, P. eous and P. sajor- caju*) for production of spawn material

P. sajor-caju *P.florida* *P.eous*

Figure 2: Growth of different spp. of *Pleurotus* by using spawned seed grain on rice straw for cultivation

required for mycelial run on different seed grain (Table 1) was maximum on rice grains (17, 18 and 20 days respectively).

The different spawn substrate showed different response on biological efficiency of *P. florida* (Table 2). Maximum biological efficiency (170.2 %) was noticed in treatment in which wheat grain used as spawn substrate followed by sorghum grain (156.2).Minimum biological efficiency (108.2 %) was recored in the treatment in which rice grain used as spawn substrate followed by garden pea seed (116.6.)

The different spawn substrate showed different response on biological efficiency of *P. eous* (Table 3). Maximum biological efficiency (166.12 %) was noticed in treatment in which sorghum grain used as spawn substrate followed by wheat grain (154.6%), maize seed (153.0%). Minimum biological efficiency (93.84 %) was recored in the treatment in which rice grain used as spawn substrate and this was followed by mung seed (105.8 %) and gram seed (121.7 %).

The different spawn substrate showed different response on biological efficiency of *P. sajor-caju* (Table 4). Maximum biological efficiency (159.4 %) was noticed in treatment in which wheat grain used as spawn substrate followed by sorghum grain (125.8%), maize seed (125.0%) and mung seed (122.2 %). Minimum biological efficiency (91.04 %) was recored in the treatment in which rice grain used as spawn substrate followed by gram seed (108.2 %) and garden pea seed (121.7 %).

The yield and biological efficiency of *P.florida, P.eous and P.sajor-caju* has been influnced by different spawn substrates. The yield and biological efficiency of *P.florida* was maximum with Wheat grain followed by sorghum whereas *P.eous and P.sajor-caju* was maximum with Sorghum grain followed by Wheat grain. Similar diffrential yield and biological efficiency with different spawn substrates has been reported by (Nary *et al*., 2011, Senthilnambi *et al*., 2011, Adebayo *et al*., 2013 and Adebayo *et al*., 2014) with their result.

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