J. Plant Production, Mansoura Univ., Vol. 5 (7): 1181-1196, 2014

STUDIES ON NUTRITION OF MUSHROOM
2- EFFECT OF SOME ORGANIC SUPPLEMENTATION TO RICE STRAW SUBSTRATE ON PRODUCTIVITY AND QUALITY OF OYSTER MUSHROOM

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ABSTRACT

This work was carried out in private farm at kaffer saker, sharkia governorate, during the period between 2009 and 2010 seasons to study the effect of some natural supplementation type to the rice straw substrate on the growth, yield and its components, physical characters and chemical constituents of oyster mushroom fruit bodies.

The obtained results showed that, the highest values of cap diameter, cap weight and stipe weight were obtained when cultivated oyster mushroom on rice straw plus wheat grains powder at 5% followed by rice straw substrate plus faba bean powder at 5%. In addition, the highest values of early yield were recorded in case of using cowpea powder at 15% while, total yield per bag and biological efficiency % were obtained when cultivated mushroom on rice straw substrate plus cotton seed powder at 10%. However, cultivation of mushroom on rice straw substrate plus soy bean powder at 15% gave the highest values of total nitrogen, crude protein, phosphorus and potassium percentages as well as total carbohydrates.

Cultivation oyster mushroom on rice straw substrate plus cowpea powder at 15% gave the maximum values of dry matter percentage and protein yield per bag.

On the contrary, cultivation oyster mushroom on sole rice straw produced the lowest values of all studied characters.

Keywords: oyster mushroom, yield, chemical constituents, natural supplementation, cotton seed powder, wheat grains powder.

INTRODUCTION

The "MUSHROOM" word is used in all part of world to describe the fruiting bodies of saprophytic, mycorrhizal and parasites fungi, belonging to the order of Basidiomycetes or Ascomycetes. They can be found in soils rich in organic matter and humus, moist wood, animal waste, etc., after heavy rain (with thunderstorm or not) or a sudden change of temperature and soon after a few hours or days they disappear, leaving no sign, but vegetative mycelium. There are at least 12,000 species of fungi that can be considered mushrooms, with at least 2000 species showing various degrees of edibility. Furthermore, over 200 species have been collected from the wild and used for various traditional medical purposes. About 35 mushroom species have been cultivated commercially, and of these, around 20 were cultivated on an industrial scale (D**Ü**ndar and Yildiz, 2009).

The genus of *pleurotus* (oyster mushroom) comprises about 40 species (Jose and Janardhanan, 2000). They are ubiquitous, being found in both

temperate and tropical parts of the world, and are now considered being the second most important cultivated mushroom in the world (Chang *et al*., 1981). Oyster mushroom belongs to class: *Basidiomycetes*, sub class; *Holobasidiomycetidae*, order: *Polyporales*.

Growing oyster mushroom is became more popular through the world and had many advantages comparing with other cultures because of their ability to grow in a wide range of temperature its highly labor intensive, short duration crop life cycle and land saving beside to using the agricultural wastes as a medium for it's growth (Moda *et al*., 2005).

One of the world's biggest challenges is food insecurity. This problem is largely common in low- and middle-income countries which mainly have poor food production system and hence, suffer from serious malnutrition. Such countries must find ways of improving food production so as to feed vastly increasing human population. Mushroom cultivation could be a possible option to alleviate poverty and develop the life style of the vulnerable people (Imtiaj and Rahman, 2008).

Mushrooms cultivation offers benefit to market gardens when it is integrated into the existing production system by producing nutritious food at a profit, while using materials that would otherwise be considered "waste" (Beetz and Kustudia, 2004). This is because mushrooms contain many essential nutrients and they are found to solve dietary related health problems (Atikpo *et al.,* 2008).

Many investigators evaluated *Pleurotus* sp yield when grown on rice straw mixed with natural supplementation. In this connection application of soybean to the substrate of mushroom cultivation increased yield of fruit bodies, crude protein, nitrogen and potassium percentage in the fruit bodies (Khattab, 2000). Addition cotton seed powder to rice straw as media for cultivating oyster mushroom (*Pleurotus florida*) enhanced yield (Shashirekha *et al*., 2005). Attia (2006) on *Pleurotus ostreatus* reported that addition of wheat bran or rice bran to rice straw at rate 0f 7.5 or 10% gave the highest fruit body weight, average of weight of cap, stipe, diameter of cap, and number of fruit bodies/bag. Rodriguez and Royse (2007) found that number and size (weight) of the basidiomata were increased when soybean was added at 8 and 12% as compared to 4 and 6%. This depended on used strain and species as well as type of used supplements. Cultivate oyster mushroom *(Pleurotus ostreatus)* on rice straw as substrate and supplemented with either broad bean husks or eucalyptus leaves 4 kg wet w: 6% wet w) the above mentioned additives caused significant increase in protein, carbohydrate and lipid content in the fruit body of *Plurotus ostreatus* (Assawah,2008). Verma *et al*., (2008) studies the effect of different supplements for enhancing the mushroom yield noticed that wheat bran supplementation increases the yield with 5% supplementation. Arisha (2010) found that addition of soybean powder at rate of 5% or 7.5% to growing media (rice straw) significantly increased the content of N, P. and K in mushroom fruit bodies of *Pleurotus florida* (strain 238)**.** Victor and Lfeanyi (2013) on *Pleurotus ostreatus* indicate a graded increase in both total and average yield of mushroom from 2.5% to 12.5%. The best results in terms of yield can be obtained by using wheat bran concentrations of 7.5% to 12.5% added to sawdust.

This study aimed to investigate the effect of some natural organic supplements to the rice straw substrate on the yield and its components, physical characters and chemical constituents of oyster mushroom fruit bodies.

MATERIALS AND METHODS

This work was carried out in special farm at kaffer saker, sharkia governorate, during the period between 2009 and 2010 seasons to study the effect of some natural organic supplements to the rice straw substrate on the yield and its components, physical characters and chemical constituents of oyster mushroom fruit bodies.

This experiment included nineteen treatments as follows:

1-Rice straw
2-Rice straw plus rice grains powder 5%.
3-Rice straw plus rice grains powder 10%.
4-Rice straw plus rice grains powder 15%.
5-Rice straw plus wheat grains powder 5%.
6-Rice straw plus wheat grains powder 10%.
7- Rice straw plus wheat grains powder 15%.
8- Rice straw plus cotton seed powder 5%.
9- Rice straw plus cotton seed powder 10%.
10- Rice straw plus cotton seed powder 15%.
11- Rice straw plus soy bean powder 5%.
12- Rice straw plus soy bean powder 10%.
13- Rice straw plus soy bean powder 15%.
14- Rice straw plus faba bean powder 5%.
15- Rice straw plus faba bean powder 10%.
16- Rice straw plus faba bean powder 15%.
17- Rice straw plus cowpea powder 5%.
18- Rice straw plus cowpea powder 10% and
19- Rice straw plus cowpea powder 15%.

Treatments were arranged in randomized complete block design system with three replicates, and each replicate consisted of two white polyethylene bags. Every bag contained 1 kg dry weight from rice straw (about 3kg weight rice straw) the dimensions of bags were 60 cm in depth × 40 cm diameter and manufactured from plastic thickness of 80 microns. This experiment was conducted in two seasons started in 28th November of both 2009 and 2010 seasons.

Preparation of rice straw

Rice straw was shopped into particles (4-5cm) and soaked in tap water for 12 hours, then left to drain the excess water, after that it was pasteurized in life steam system at 80-90 ^{O}C for 6 hours. These pasteurized rice straw were left to reach to room temperature (Zadrazil, 1978).

Addition of natural supplements

All supplements were added as a powder to the content of each bag at the previously mentioned levels (w/w) and mixed with rice straw after pasteurization and just before spawning. Then the substrate were get out and spread in a 10cm layer thickness four layers into polyethylene bags and the

spawn was distributed over each layer at the rate of 15% (W/W) (this equal 150g spawn per bag).

The chemical analysis of the used supplements before spawning were listed in Table 1

Table 1: chemical analysis of the used supplements

Supplements	Chemical analysis (%)						
	N%	P%	K%	Protein	O.M%	(C %)	(C/N)
Rice grains powder	2.84	0.278	2.16	17.75	78.6	45.7	16.1/1
Wheat grains powder	3.21	0.405	3.89	20.06	75.8	44.1	13.7/1
Cotton seed powder	3.08	0.362	1.98	19.25	80.5	46.8	15.2/1
Soybean powder	4.03	0.427	3.02	25.19	78.3	45.5	11.3/1
Faba bean powder	3.49	0.391	2.53	21.81	77.4	45.0	12.9/1
Cowpea powder	3.63	0.339	2.88	22.69	76.2	44.3	12.2/1

Mycelial growth

The inoculated polyethylene bags were transferred to the incubation room at the temperature 25± 3 ^{0}C with less ventilation and darkness till full colonization (two-three weeks). Then the polyethylene bags were pinned and transferred to the production room, where the temperature was 20±3 ^{0}C and relative humidity was maintained to about 80-90% using a foggy system.

The polyethylene bags were perforated to have enough aeration needed for fungal growth; the holes were 1cm diameter and were distributed as 10 cm between each others.

In this study, the source of *Pleurotus florida* (strain 238) was the Research Institute of Food Technology, Agriculture Research Center, Giza-Egypt.

Data recorded

Growth characters

Two oyster mushroom clusters were taken from each treatment of the first flush (first 15 days), and the following data were recorded:

1. Cap diameter.
2. Cap weight.
3. Cap weight /fruit body weight ratio
4. stipe weight.

Yield and its components

At suitable harvesting stage, all clusters were harvested and the following data were recorded:

1. Number of cluster / bag.
2. Number of fruit bodies / bag.
3. Average of cluster weight.
4. Average of fresh weight of fruit body.
5. Total fresh yield /bag.
6. Early yield / bag.

It was calculated from the first 15 days from the beginning of harvesting.

7. Early yield / total yield ratio
8. Biological efficiency

It was defined as percentage of the fresh weight of harvested mushroom over the dry weight of substrate as explained by Zervakis and Balis (1992)

Chemical constituents of fruit bodies

1. Dry matter percentage (D.M. %)

Sample of 100 g of fruit bodies from each replicate was dried in an electrical oven at 105ºC till constant weight and DM% was determined.

2. Minerals, protein and total carbohydrates

Sample of 50 g of fruit bodies from each replicate as well as sample of 200 g from each used substrate before spawning and after harvesting, were taken, then dried (by using an electrical oven) at 70ºC till constant weight. The dried materials were grinded to a fine powder for the following chemical analysis.

1. Minerals determination

Nitrogen, phosphorus and potassium were determined according to the methods described by Bremner and Mulvaney (1982), Olsen and Sommers (1982) and Jackson (1970), respectively.

2. Crude protein (%)

It was determined as nitrogen content and multiplied by 6.25 to convert it to equivalent protein content for fruit bodies (Fujihara *et al.,* 1995).

3. Total carbohydrates (%)

It was determined following the method described by (DÜbois *et al.,* 1956).

Statistical Analysis

The obtained data were subjected to statistical analysis of variance according to Snedecor and Cochran (1982) and means separation were done according to Duncan (1958).

RESULTS AND DISCUSSION

Effect of some natural supplementation to rice straw substrate on growth characters of mushroom fruit bodies

The obtained results in Table 2 show the effect of some natural supplementation to rice straw on growth characters of oyster mushroom. It is quite clear from such results that, the maximum values of cap diameter were obtained when mushroom grown on rice straw substrate plus wheat grains at 5% (8.9 and 9.1cm) followed by using rice straw plus faba bean powder at 5% (8.4 and 9.1cm) in the first and second season, respectively, without any significant differences between them. On the other hand, the minimum values of cap diameter of fruit bodies were produced by using rice straw alone, these results are true in both seasons of study.

Regarding cap weight, the same data in Table 2 reveale that, the highest values of cap weight were obtained when mushroom grown on rice straw plus faba bean powder at 5% (18.00 and 18.26g) followed by rice straw plus wheat grains at 5%(17.10 and 18.70) and rice straw plus cowpea powder at 5% (17.10and 19.10g) without any significant differences among the three treatments. On the other side the lowest values of cap weight were recorded when cultivating mushroom on sole rice straw.

As for cap weight/fruit body weight ratio, it is also clear from the same data that, the highest values in this respect were obtained when mushroom grown on rice straw plus faba bean powder at 5% (88.98 and 87.72%) in the first and second season, respectively, followed by rice straw plus cowpea at 15% without significant differences between them during both seasons. While, cultivating oyster mushroom on rice straw plus soybean powder at 5% gave the lowest values of cap weight/ fruit body weight ratio, these results are true in the two seasons of study. Concerning stipe weight, it is quit clear from such results that, stipe weight was heavier by growing oyster mushroom on rice straw plus rice grains powder at 5% (4.30g) in the first season followed by rice straw plus soybean powder at 5% (3.90g) without significant differences between them. While, cultivating mushroom on rice straw plus wheat grains powder at 5% recorded the highest values of stipe weight in the second season (4.62g) followed by rice straw plus rice grains powder at 5% (4.46g) without significant differences between them.

On the other hand, the lowest values of stipe weight were recorded when mushroom grown on rice straw plus faba bean powder at 15% (1.70g) in the first season and rice straw plus cowpea powder at 15% (2.10g) in the second one. These results are in harmony with those reported by Attia (2006) on *Pleurotus ostreatus.*

Effect of some natural supplementation to rice straw substrate on number of cluster per bag, number of fruit bodies per bag, weight of cluster and fresh weight of fruit body

it could be noted from the data in Table 3 that, the highest values of number of cluster per bag were recorded when cultivating oyster mushroom on rice straw substrate plus wheat grains powder at 10% (14.7and 12.7)followed by rice straw plus cottons seed at 10%(14.3 and 14.0) in the first and second season, respectively, without significant differences between them. On the other side, the lowest values in this respect were recorded when oyster mushroom grown on both sole rice straw substrate and rice straw plus cowpea powder at15%. Regarding number of fruit bodies per bag, the same data in Table 3 reveale that, the maximum values in this respect were obtained when mushroom grown on rice straw with either soybean powder at 15% (107.8 and 113.2) or cowpea powder at 15% (108.25and 107.0) in the first and second season, respectively, without significant differences between them. While the minimum values were produced by using rice straw substrate plus faba bean powder at 5%. As for average of cluster weight, it is also clear from the same data that, the maximum values of average of cluster weight were recorded by using rice straw plus cowpea powder at 15% (229.8 and 191.8g) in the two seasons, respectively, while the minimum values in this respect were recorded from oyster mushroom grown on rice straw substrate alone which gave 123.5 and 144.7g in the two seasons,respectively.

Concerning average fresh weight of fruit body, it could be noted from such results that, the highest values in this respect were obtained when cultivating oyster mushroom on rice straw plus faba bean powder at 5% followed by rice straw plus wheat grains powder at 5% and rice straw plus cowpea powder at 5% as well as rice straw plus rice grains powder at 5% in

both seasons of study without significant differences among them, while, the lowest values were recorded by using sole rice straw.

Effect of some natural supplementation to the rice straw substrate on yield and its components of fruit bodies

It is quite clear from the obtained data in Table 4 that there were significant differences among the tested supplementations concerning early yield of fruit bodies per bag, in this respect the highest values were more pronounced from growing mushroom on rice straw substrate plus cowpea powder at 15%
(1031.5 and 1036.0 g) and rice straw substrate plus cotton seed powder at10% (936.8 and 942.5g) in the first and second seasons, respectively.

On the contrary, using rice straw substrate alone gave the lowest early yield per bag as compared to the other used supplementation.

With regards to total yield per bag, it is also clear from the same data that, rice straw substrate plus cotton seed powder at 10% or rice straw substrate plus wheat grains powder at 10% were the best supplementation for increasing total yield of oyster mushroom as compared to the other tested treatments. Also, the total yield per bag obtained from growing mushroom on rice straw alone was the least medium in this concern as compared to other studied treatments.

From the abovementioned results it could be suggested that the superiority in total yield of mushroom fruit bodies may be due to the increase in number of clusters per bag by this treatment.

Concerning early yield / total yield ratio of oyster mushroom, the same data in Table 4 indicate that using rice straw substrate plus rice grains powder at 5% and rice straw substrate plus cowpea powder at 15% recorded the maximum values of early yield / total yield ratio as compared to other treatments. While, rice straw substrate plus soybean powder at 15% resulted in the lowest early yield / total yield ratio. These results are true in both growing seasons of study.

With regards to biological efficiency percentage (B.E.), it is also clear from the same data that, the maximum values of biological efficiency percentage were recorded when mushroom grown on rice straw substrate plus cotton seed powder at 10% (172.8 and 177.1%) in the two seasons, respectively followed by rice straw substrate plus wheat grains powder at 10% (169.2 and 173.4%).

On the other hand, the minimum values of biological efficiency percentage were produced by using sole rice straw substrate 118.2 and 122.6 in the two seasons, respectively. These results are in harmony with those reported by Shashirkha *et al*., (2005), Attia (2006) on *Pleurotus ostreatus* and Victor and Lfeanyi (2013) on *Pleurotus ostreatus*

Effect of some natural supplementation to the rice straw substrate on nitrogen, phosphorus and potassium percentages in oyster mushroom fruit bodies

As for the effect of natural supplements on total nitrogen, phosphorus and potassium percentage it is evident from the presented results in Table 5 that, all used treatments caused a significant and marked effect in this respect.

The highest values of nitrogen and potassium percentages were obtained by cultivating oyster mushroom on rice straw substrate plus soybean powder at 15% (5.55and 5.52%) and (4.76 and 4.75%) followed by rice straw substrate plus faba bean powder at 15% (5.51 and 5.46%) and (4.70 and 4.67%) in the first and second seasons, respectively with non significant differences between them. This means that production of oyster mushroom on rice straw substrate mixed with soybean powder or faba bean powder each of them at 15% produced beneficial results regarding total nitrogen content. On the other side, cultivation of oyster mushroom on rice straw substrate alone gave fruit bodies with low nitrogen percentage. These results are true in the two studied seasons.

Table 5: Effect of some natural supplementation to the rice straw substrate on nitrogen, phosphorus and potassium percentages in oyster mushroom fruit bodies during 2009 and 2010 seasons

Parameters / Treatments	N %				P %				K %			
	1st season		2nd season		1st season		2nd season		1st season		2nd season	
Sole rice straw	4.65	k	4.61	j	0.937	i	0.933	e	3.96	m	3.94	m
Rice straw + rice grains powder 5%	4.82	h-n	4.78	h-j	0.965	g-i	0.960	de	4.13	kl	4.00	lm
Rice straw + rice grains powder 10%	5.02	f-i	4.95	f-h	0.998	e-i	0.994	c-e	4.30	g-j	4.23	hi
Rice straw + rice grains powder 15%	5.35	a-d	5.32	a-d	1.060	b-d	1.042	b-e	4.56	b-e	4.53	de
Rice straw + wheat grains powder 5%	4.70	jk	4.67	ij	0.945	i	0.942	e	4.01	lm	4.00	lm
Rice straw + wheat grains powder 10%	4.97	f-j	4.94	f-h	0.994	e-i	1.170	a	4.25	h-k	4.17	ij
Rice straw + wheat grains powder 15%	5.31	a-e	5.23	b-e	1.053	b-e	1.046	b-e	4.52	c-f	4.46	ef
Rice straw + cotton seed powder 5%	4.75	i-k	4.71	ij	0.953	hi	1.003	b-e	4.07	lm	4.03	kl
Rice straw + cotton seed powder 10%	5.08	e-h	5.06	e-g	1.010	d-h	1.048	b-e	4.33	g-i	4.26	h
Rice straw + cotton seed powder 15%	5.40	a-d	5.36	a-c	1.069	b-d	1.121	ab	4.61	a-d	4.57	cd
Rice straw + soy bean powder 5%	4.92	g-k	4.87	g-i	0.981	f-i	0.963	de	4.23	i-k	4.21	hi
Rice straw + soy bean powder 10%	5.24	b-f	5.17	c-f	1.033	b-f	1.094	a-c	4.49	d-f	4.44	f
Rice straw + soy bean powder 15%	5.55	a	5.52	a	1.160	a	1.045	b-e	4.76	a	4.75	a
Rice straw + faba bean powder 5%	4.88	g-k	4.85	g-i	0.973	f-i	0.992	c-e	4.15	j-l	4.11	jk
Rice straw + faba bean powder 10%	5.20	c-f	5.16	c-f	1.031	b-f	1.017	b-e	4.45	e-g	4.43	fg
Rice straw + faba bean powder 15%	5.51	ab	5.46	a	1.091	b	1.041	b-e	4.70	ab	4.67	ab
Rice straw + cowpea powder 5%	4.81	h-k	4.79	h-j	0.962	g-i	0.982	c-e	4.11	k-m	4.08	k
Rice straw + cowpea powder 10%	5.13	d-g	5.12	d-f	1.022	c-g	1.043	b-e	4.39	f-h	4.35	g
Rice straw + cowpea powder 15%	5.46	a-c	5.44	ab	1.078	bc	1.071	a-d	4.67	a-c	4.62	bc

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance according to Duncan's multiple range test

As for phosphorus percentage, it is evident from the obtained results in Table 5 that, production of oyster mushroom on rice straw substrate plus soybean powder at 15% significantly increased phosphorus percentage in fruit bodies in the first season of study over those produced by other tested treatments, while growing oyster mushroom on rice straw plus wheat grains powder at 10% recorded the highest values of phosphorus percentage in the second season followed by rice straw substrate plus cowpea powder at 15% with non significant differences between them. On the other hand, the lowest values in this connection were more distinct via using sole rice straw substrate, these results are true in both seasons of study.

The results in Table 5 indicate also that, using rice straw plus soy bean powder at15% and rice straw plus faba bean powder at15% being the most effective and favorable treatments, for increasing potassium percentage in fruit bodies as compared with the other tested treatments. These results hold true in both seasons of study. Similar results were reported by Khattab (2000) and Arisha (2010) on *Pleurotus florida* .

Effect of some natural supplementation to the rice straw substrate on dry matter%, Protein yield/ bag, crude protein and carbohydrate percentage in fruit bodies

It is clear from the data in Table 6 that, the maximum values of dry weight percentage of oyster mushroom fruit bodies were recorded by using rice straw substrate plus cowpea powder at 15% (11.75 and 11.78%) in the two seasons, respectively followed by rice straw substrate plus cotton seed powder at 15% without significant differences between them, while the minimum values of dry weight % were recorded from oyster mushroom fruit bodies grown on rice straw substrate alone which gave 6.59 and 6.63% in the two seasons, respectively. These results are true in both seasons of study.

Concerning protein yield per bag, the same data in Table 6 indicate that cultivating oyster mushroom on rice straw substrate plus cowpea powder at 15% recorded the maximum values of protein yield per bag (67.55 and 68.52g) in the 1^{st} and 2^{nd} season, respectively as compared to other supplementation. While, cultivation of oyster mushroom on rice straw substrate alone recorded the lowest values in this respect. Concerning crude protein percentage, the same data in Table 6 indicate that, the highest values in this respect were obtained by cultivating oyster mushroom on rice straw substrate plus soybean powder at 15% (34.69and 34.48%),rice straw substrate plus faba bean powder at 15% (34.44 and 34.12%) and rice straw substrate plus cowpea powder at 15% (34.12 and 33.98%) in the first and second seasons, respectively with non significant differences among them. This means that production of mushroom on rice straw substrate mixed with soybean powder, faba bean powder or cowpea powder each of them at 15% produced beneficial results regarding crude protein content. On the other hand, cultivation of oyster mushroom on rice straw substrate alone gave fruit bodies with low crude protein percentage, these results are true in the both seasons of study.

With regards to total carbohydrates percentage, it is clear from the obtained data in Table 6 that, rice straw substrate plus soybean powder at 15% or rice straw substrate plus faba bean powder at 15% were the best supplementation for increasing total carbohydrates percentage in fruit bodies of oyster mushroom as compared to the other tested supplementation. While, cultivation of oyster mushroom on rice straw substrate alone gave the lowest values of total carbohydrates percentage, these results are true in both seasons of study. These results were agreed with the findings of Khattab (2000) and Arisha (2010) on *Pleurotus florida*.

CONCLUSION

From the above mentioned results and discussion, it could be concluded that addition of all natural supplementation under study to rice straw substrate at all cases increased early, total yield and enhanced chemical constituents of oyster mushroom, the best treatments were rice straw plus cowpea powder at 15% for early yield and rice straw plus cotton seed powder at 10% followed by using rice straw plus wheat grains powder at10% for producing higher total fruit yield .

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دراسات على تغذية عيش الغراب المحارى
٢- تأثير إضافة بعض المواد العضوية إلى بيئة قش الأرز على إنتاجية وجودة عيش الغراب المحارى

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أجريت هذه الدراسة خلال الفترة من ٢٠٠٩ إلى ٢٠١٠ فى مزرعة خاصة لإنتاج عيش الغراب المحارى بكفر صقر ، محافظة الشرقية ، لدراسة تأثير إضافة بعض المواد العضوية إلى بيئة قش الأرز على النمو والمحصول ومكوناته ، والصفات الفيزيائية والمحتوى الكيماوى للأجسام الثمرية لفطر عيش الغراب المحارى.

أوضحت النتائج المتحصل عليها أن أعلى القيم بالنسبة لكل من قطر المظلة ، وزن المظلة و وزن الساق تم الحصول عليها عند زراعة فطر عيش الغراب المحارى على بيئة قش الأرز المضاف إليها مسحوق حبوب القمح بنسبة ٥% يليها بيئة قش الأرز المضاف إليها مسحوق حبوب الفول البلدى بنسبة ٥% .

بينما سُجلت أعلى القيم بالنسبة لكل من المحصول المبكر عند الزراعة على بيئة قش الأرز المضاف إليها مسحوق بذوراللوبيا بنسبة ١٥% بينما تم الحصول على أعلى محصول كلى للكيس و الكفاءة البيولوجية % عند زراعة فطر عيش الغراب المحارى على بيئة قش الأرز المضاف إليها مسحوق بذرة القطن بنسة ١٠% .

من ناحية أخرى أظهرت النتائج أن زراعة فطر عيش الغراب المحارى على بيئة قش الأرز المضاف إليها مسحوق بذور فول الصويا بنسبة ١٥% سجلت أعلى القيم بالنسبة لمحتوى الأجسام الثمرية من النيتروجين، البروتين الكلى ،الفوسفور و البوتاسيوم وكذلك الكربوهيدرات الكليه . وعلى العكس من ذلك فإن زراعة فطر عيش الغراب المحارى على بيئة قش الأرز منفردا سجلت أقل القيم بالنسبة لجميع الصفات تحت الدراسة.

Table 2: Effect of some natural supplementation to the rice straw substrate on cap diameter, cap weight, stipe weight and cap weight /fruit body weight ratio of oyster mushroom fruit bodies during 2009 and 2010 seasons

Parameters / Treatments	Cap diameter (cm)				Cap weight (g)				Cap weight /fruit body weight ratio				Stipe weight (g)			
	1st season		2nd season		1st season		2nd season		1st season		2nd season		1st season		2nd season	
Sole rice straw	7.10	f	6.80	h	10.90	j	10.40	i	80.08	c-f	80.77	b-g	2.60	b-e	2.50	e-g
Rice straw + rice grains powder 5%	8.30	a-e	8.50	a-d	16.50	b	17.00	bc	80.46	c-f	79.12	c-g	4.30	a	4.46	ab
Rice straw + rice grains powder 10%	7.90	b-f	7.80	c-h	13.70	d-f	14.20	e-g	81.02	c-e	80.02	b-g	3.20	a-d	3.54	a-e
Rice straw + rice grains powder 15%	7.40	ef	7.50	d-h	12.90	e-g	13.50	fg	83.22	a-e	83.92	a-d	2.60	b-e	2.60	d-g
Rice straw + wheat grains powder 5%	8.90	a	9.10	a	17.10	ab	18.70	a	82.52	b-e	84.03	a-d	3.70	ab	4.62	a
Rice straw + wheat grains powder 10%	8.50	a-c	8.40	a-e	14.00	c-e	13.80	e-g	79.50	c-f	75.10	fg	3.60	ab	3.54	a-e
Rice straw + wheat grains powder 15%	8.00	a-f	7.60	c-h	12.60	f-h	12.90	gh	82.91	b-e	81.54	a-f	2.60	b-e	2.83	c-g
Rice straw + cotton seed powder 5%	8.20	a-e	8.30	a-f	16.60	b	16.83	c	84.36	a-d	79.38	c-g	3.10	a-d	4.37	ab
Rice straw + cotton seed powder 10%	7.80	b-f	8.00	b-g	12.70	fg	13.50	fg	77.56	e-f	77.57	d-g	3.70	ab	4.27	ab
Rice straw + cotton seed powder 15%	7.50	d-f	7.80	c-h	12.20	g-i	13.20	fg	77.74	e-f	75.56	e-g	3.50	a-c	3.00	ab
Rice straw + soy bean powder 5%	8.10	a-e	7.90	b-g	11.50	h-j	11.70	hi	74.71	f	74.25	g	3.90	ab	3.76	a-d
Rice straw + soy bean powder 10%	7.90	b-f	7.70	c-h	11.10	I j	10.90	i	78.67	d-f	76.79	e-g	3.00	a-e	3.30	b-f
Rice straw + soy bean powder 15%	7.60	c-f	7.30	f-h	11.00	j	11.30	i	78.87	d-f	83.83	a-d	3.00	a-e	2.20	fg
Rice straw + faba bean powder 5%	8.40	a-d	9.10	a	18.00	a	18.26	ab	84.97	a-c	82.29	a-e	3.20	a-d	3.90	a-c
Rice straw + faba bean powder 10%	7.60	c-f	8.60	a-c	14.80	cd	15.70	cd	80.12	c-f	80.24	b-g	3.70	ab	3.26	a-d
Rice straw + faba bean powder 15%	7.50	d-f	7.40	e-h	13.60	ef	14.50	d-f	88.98	a	87.72	a	1.70	e	2.20	fg
Rice straw + cowpea powder 5%	8.60	ab	8.90	ab	17.10	ab	19.10	a	82.75	b-e	87.62	a	3.60	ab	2.70	c-g
Rice straw + cowpea powder 10%	8.30	a-e	7.90	b-g	15.10	c	15.20	de	87.37	ab	85.78	a-c	2.20	c-e	2.50	d-g
Rice straw + cowpea powder 15%	7.70	b-f	7.20	gh	13.60	ef	13.90	e-g	87.18	ab	86.87	ab	1.90	de	2.10	fg

Table 3: Effect of some natural supplementation to the rice straw substrate on number of clusters/ bag, number of fruit bodies/bag, cluster weight , fresh wight of fruit body and fruit bodies of oyster mushroom during 2009

Treatments \ parameters	No. of clusters/ bag				No. of fruit bodies/ bag				Average of cluster weight (g)				Average fresh wight of fruit body (g)			
	1st season		2nd season		1st season		2nd season		1st season		2nd season		1st season		2nd season	
Sole rice straw	9.67	d-f	8.67	b	87.63	de	92.22	d-f	123.51	c	144.7	a-c	13.50	h	12.90	h
Rice straw + rice grains powder 5%	12.00	a-e	10.33	ab	65.42	gh	62.35	hi	113.59	c	134.5	a-c	20.80	a	21.46	a
Rice straw + rice grains powder 10%	12.33	a-e	11.67	ab	88.73	d	86.54	f	126.69	c	131.8	a-c	16.90	c-f	17.74	cd
Rice straw + rice grains powder 15%	13.33	a-c	12.33	ab	97.97	a-d	96.56	c-f	115.03	c	126.7	c	15.50	e-g	16.10	d-f
Rice straw + wheat grains powder 5%	10.67	c-f	10.00	ab	66.17	gh	63.04	hi	129.93	c	144.2	a-c	20.90	a	22.24	a
Rice straw + wheat grains powder 10%	14.67	a	12.67	ab	96.45	b-d	94.33	d-f	115.37	c	136.8	a-c	17.60	cd	18.42	bc
Rice straw + wheat grains powder 15%	11.67	a-e	11.00	ab	100.04	a-c	98.54	b-e	131.09	c	142.2	a-c	15.20	f-h	15.73	f
Rice straw + cotton seed powder 5%	13.00	a-d	12.00	ab	75.45	fg	71.46	gh	114.64	c	128.1	bc	19.70	ab	21.20	a
Rice straw + cotton seed powder 10%	14.33	ab	14.00	a	105.75	ab	100.91	b-d	120.59	c	126.5	bc	16.40	d-f	17.57	c-e
Rice straw + cotton seed powder 15%	11.33	a-e	12.33	ab	96.13	b-d	88.42	ef	134.46	c	128.7	bc	15.70	d-g	17.47	c-e
Rice straw + soy bean powder 5%	10.33	c-f	9.33	b	95.42	b-d	95.70	d-f	142.43	bc	160.7	a-c	15.40	e-h	15.46	fg
Rice straw + soy bean powder 10%	10.67	c-f	8.67	b	104.91	ab	106.41	a-c	139.68	bc	175.8	a-c	14.10	gh	14.20	gh
Rice straw + soy bean powder 15%	11.00	b-f	9.00	b	107.85	a	113.23	a	137.29	bc	170.8	a-c	14.00	gh	13.50	h
Rice straw + faba bean powder 5%	9.67	d-f	10.00	ab	58.70	h	57.13	i	131.91	c	128.9	bc	21.20	a	22.16	a
Rice straw + faba bean powder 10%	10.33	c-f	11.00	ab	78.82	ef	75.33	g	146.62	bc	146.9	a-c	18.50	bc	19.60	b
Rice straw + faba bean powder 15%	9.33	ef	9.33	b	108.12	a	101.79	b-d	185.43	b	189.4	ab	15.30	e-h	16.20	d-f
Rice straw + cowpea powder 5%	10.00	c-f	10.33	ab	71.14	fg	68.91	gh	150.42	bc	160.5	a-c	20.70	a	21.80	a
Rice straw + cowpea powder 10%	10.67	c-f	10.67	ab	90.35	cd	90.00	ef	147.36	bc	164.1	a-c	17.30	c-e	17.70	cd
Rice straw + cowpea powder 15%	7.67	f	9.00	b	108.25	a	107.00	ab	229.88	a	191.7	a	15.60	e-g	16.00	ef

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance according to Duncan's multiple range test

Table 4: Effect of some natural supplementation to the rice straw substrate on yield and its components of fruit bodies and Biological efficiency of oyster mushroom during 2009 and 2010 seasons

Parameters / Treatments	Early yield/ bag (g)				Total yield/ bag (g)				Early yield/ Total yield%				Biological efficiency%			
	1st season		2nd season		1st season		2nd season		1st season		2nd season		1st season		2nd season	
Sole rice straw	719.6	j	704.3	j	1182.5	m	1226.0	n	60.85	b	57.45	cd	118.25	m	122.60	n
Rice straw + rice grains powder 5%	870.6	d	876.6	d	1356.7	k	1386.7	l	64.17	a	63.22	a	135.67	k	138.67	l
Rice straw + rice grains powder 10%	826.8	e	837.8	e	1499.2	f-h	1534.7	gh	55.15	ef	54.59	e-g	149.92	e-g	153.47	gh
Rice straw + rice grains powder 15%	823.0	e	832.1	e	1522.0	e	1552.3	fg	54.08	fg	53.61	f-h	152.20	e	155.23	fg
Rice straw + wheat grains powder 5%	786.9	g	793.5	g	1376.0	k	1401.7	l	57.18	d	56.61	c-e	137.60	k	140.17	l
Rice straw + wheat grains powder 10%	877.1	d	876.5	d	1692.5	b	1734.0	b	51.81	i	50.42	jk	169.25	b	173.40	b
Rice straw + wheat grains powder 15%	760.3	h	765.3	h	1520.0	ef	1559.3	f	50.02	k	49.08	k	152.00	e	155.93	f
Rice straw + cotton seed powder 5%	834.7	e	838.3	e	1485.0	g-i	1514.0	ij	56.21	de	55.40	d-f	148.50	f-h	151.40	ij
Rice straw + cotton seed powder 10%	936.8	b	942.5	b	1728.0	a	1771.0	a	54.11	fg	50.92	i-k	172.80	a	177.10	a
Rice straw + cotton seed powder 15%	806.3	f	812.8	f	1506.3	e-g	1544.0	f-h	53.53	gh	52.64	g-i	150.62	ef	154.40	f-h
Rice straw + soy bean powder 5%	742.0	i	747.5	i	1450.0	j	1475.7	k	51.49	ij	50.66	i-k	145.00	j	147.57	k
Rice straw + soy bean powder 10%	746.0	i	746.6	i	1478.3	hi	1506.0	j	50.46	jk	49.58	k	147.83	g-i	150.60	j
Rice straw + soy bean powder 15%	746.5	i	753.0	i	1502.0	e-g	1525.3	hi	49.70	k	49.37	k	150.20	e-g	152.53	hi
Rice straw + faba bean powder 5%	670.0	k	666.3	k	1240.0	l	1264.0	m	54.04	fg	52.05	h-j	124.00	l	126.40	m
Rice straw + faba bean powder 10%	782.9	g	790.8	g	1455.0	j	1472.7	k	53.81	fg	53.70	f-h	145.50	ij	147.27	k
Rice straw + faba bean powder 15%	866.3	d	870.8	d	1650.0	c	1682.7	d	52.50	hi	51.76	h-j	165.00	c	168.27	d
Rice straw + cowpea powder 5%	792.2	g	800.5	g	1470.0	ij	1502.3	j	53.91	fg	53.28	gh	147.00	h-j	150.23	j
Rice straw + cowpea powder 10%	912.6	c	917.3	c	1560.0	d	1591.0	e	58.50	c	57.60	c	156.00	d	159.10	e
Rice straw + cowpea powder 15%	1031.5	a	1036.0	a	1685.5	b	1711.7	c	61.21	b	60.53	b	168.55	b	171.17	c

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance according to Duncan's multiple range test.
The dry weight of the substrate in each bag was 1 Kg for calculation biological efficiency

Table 6: Effect of some natural supplementation to the rice straw substrate on dry matter%, Protein yield/ bag, crude protein percentage and carbohydrate percentage in fruit bodies during 2009 and 2010 seasons

parameters / Treatments	Dry matter (%)				Protein yield/ bag (gm)				Crude protein (%)as D.W. basis				Total Carbohydrates (%)as D.W. basis			
	1st season		2nd season		1st season		2nd Season		1st season		2nd season		1st season		2nd season	
Sole rice straw	6.59	j	6.63	i	22.68	j	23.37	j	29.06	k	28.79	k	47.73	j	47.18	k
Rice straw + rice grains powder 5%	7.83	hi	8.02	fg	31.98	i	33.21	hi	30.13	h-k	29.89	i-k	48.03	g-j	47.95	ij
Rice straw + rice grains powder 10%	9.11	d-f	9.19	e	42.84	fg	43.48	f	31.38	f-i	30.96	f-i	48.25	e-j	48.17	h
Rice straw + rice grains powder 15%	10.44	b	10.62	b	53.25	b-d	54.89	cd	33.50	a-d	33.27	a-d	48.81	a-d	48.77	d
Rice straw + wheat grains powder 5%	8.00	hi	8.06	fg	32.37	i	32.96	hi	29.38	jk	29.19	jk	47.84	ij	47.81	j
Rice straw + wheat grains powder 10%	8.46	f-h	8.49	f	44.46	f	45.46	f	31.06	f-j	30.87	g-i	48.17	a-j	48.13	h
Rice straw + wheat grains powder 15%	9.11	d-f	9.09	e	45.95	ef	46.34	f	33.18	a-e	32.71	b-e	48.75	a-e	48.72	d
Rice straw + cotton seed powder 5%	7.48	i	7.50	h	32.98	i	33.40	hi	29.69	i-k	29.44	jk	47.91	h-j	47.86	j
Rice straw + cotton seed powder 10%	10.05	bc	10.10	c	55.13	bc	56.57	bc	31.75	e-h	31.65	e-h	48.36	d-i	48.33	g
Rice straw + cotton seed powder 15%	11.54	a	11.55	a	53.47	b-d	59.81	b	33.75	a-d	33.52	a-c	48.90	a-d	48.86	cd
Rice straw + soy bean powder 5%	7.92	hi	7.72	gh	35.26	hi	34.71	h	30.75	g-k	30.44	h-j	48.12	f-j	48.09	hi
Rice straw + soy bean powder 10%	9.08	d-f	9.17	e	44.06	f	44.56	f	32.75	b-f	32.29	c-f	48.63	a-f	48.58	e
Rice straw + soy bean powder 15%	10.00	bc	10.09	c	52.06	cd	53.05	de	34.69	a	34.48	a	49.18	a	49.16	a
Rice straw + faba bean powder 5%	8.15	g-i	8.13	fg	30.85	i	31.17	i	30.49	g-k	30.33	h-j	48.05	f-j	48.02	hi
Rice straw + faba bean powder 10%	9.43	c-e	9.45	de	44.61	f	44.86	f	32.50	c-f	32.23	c-g	48.57	b-g	48.52	ef
Rice straw + faba bean powder 15%	10.16	bc	10.23	bc	57.72	b	58.76	b	34.44	ab	34.12	a	49.08	ab	49.03	ab
Rice straw + cowpea powder 5%	8.77	e-g	8.55	f	38.75	gh	38.44	g	30.06	h-k	29.92	i-k	47.98	h-j	47.94	ij
Rice straw + cowpea powder 10%	9.83	b-d	9.82	cd	49.15	de	50.06	e	32.06	d-g	32.02	d-g	48.44	c-h	48.41	fg
Rice straw + cowpea powder 15%	11.75	a	11.78	a	67.55	a	68.52	a	34.12	a-c	33.98	ab	48.97	a-c	48.94	bc

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance according to Duncan's multiple range test

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