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Effect of some Organic Addition to Rice Straw Substrate on Production of Oyster Mushroom

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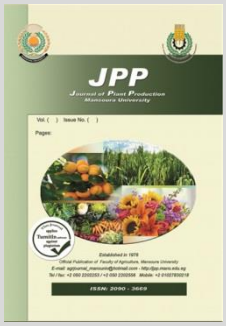

ABSTRACT

This research was conducted in the Mushroom Research Laboratory at Al-Qasasin Research Station, Ismailia Governorate. The research was conducted over two successive seasons, 2019 and 2020. This experiment aimed to study the effect of some organic additives to the rice straw environment on the physical crop and its husks. Components of the bodies of the oyster mushroom (Pleurotus Florida strain 14).These parameters were measured during the experiment of cap diameter, cap weight, fruit body weight, dry matter, early yield (gm), total yield, N.P.K. contents, carbohydrate, and protein content. The results showed significant differences in all the traits under study, and the use of rice straw + humic acid at an at 5% achieved the highest values in most of these traits. Regarding the chemical components of the fruit bodies, the use of rice straw + humic acid enhances the proportions of dry matter, phosphorous, nitrogen, protein, and total carbohydrates. Also, applied coffee residues to rice straw were recorded In general; the results indicated that using rice straw with humic acid at the rate of 15 %as growth substrate to oyster mushroom was table substrate as compared to other applications

Keywords: Pleurotus Florida, organic Adidditions.

INTRODUCTION

Oyster mushroom belongs to the genus Pleurotus, one of the most famous mushrooms in the Middle East and the world. The world consumption amounts of oyster mushrooms have come up to the fifth among edible fungi produced by over 40 thousand tons per year (Ahmed, 1998). Oyster mushroom grows well on many agricultural substrates and is easy to grow for a beginner grower. Oyster mushroom has a broad adaptability for growing under various climatic conditions and on different nutritive substrates (El-Bagori *et al.*1996).

Anuradha *et al.* (2012) supplement with flaxseed powder (10% to 50% dry weight) has been used as a potential raw material to improve the nutritional quality of the mushrooms. The maximum protein content in Oyster mushroom was obtained in the fruit hulls produced when soybean straw was replaced 44.268 g%. With 20% flaxseed powder (based on dry weight). Fatty acid profile analysis indicates that mushroom species cannot bioconvert A.L.A. flax

Zahida *et al.* (2020) studied the application of humic acid to substreteon in ition to initiation of pinheads, yield, biological efficiency ,minerals (N, P, K, Zn, Cu, Mg, Mn, Fe, Na and Ca), ascorbic acid, sugars (total sugars, reducing and non-reducing sugars), proximate, total soluble solids , acidity, and Fourier-transform infrared spectroscopy,The results showed that humic acid. amalgamation notably improved the growth, nutritional and chemical composition of oyster mushroom; however, strains differences were non-significant

Juan *et al.* (2021) The results obtained from mushroom production through Waste of ground coffee and pulp is feasible and profitable in San Salvador. Use of coffee waste In mushroom production will reduce Waste or biomass from the coffee industry,Therefore, it is an environmentally sustainable alternative. Furthermore, economic analyzes from P.I.'s It was 3.047052287, since it was >1. Therefore, the project was accepted, while the the discount rate was 51.47% per annum, i.e, .

Woon *et al.* (2021). This result indicates that Pleurotus spp. The levels of caffeine and phenolic compounds in spent coffee grounds. can be reduced by bioaccumulation and biodegradation, respectively. Then, acid sulfate up to 20% (w/w) of spent coffee grounds significantly over the main compositions, mineral contents, and fatty acid profiles of the main galleries.

Mohammed *et al* (2020) Mentioned that nutritional value of mushrooms is improved by the general increase in carbohydrates and a decrease in Sodium content 33% and 67% coffee, 33% lower fat content coffee, Polyunsaturated fat Mushroom acids (Polyunsaturated fatty acids) increased by 67% from Coffee; While saturated spent fatty acids.) increased by 33 and 67% coffee. All mushrooms contain Polyunsaturated fatty acids / fatty acids shortly, between 7.4 and 8.1. The study suggests using Coffee as a food supplement to commercial wheat straw.

Information about the production of oyster mushrooms under Egyptian conditions is not available. Therefore, the present study was conducted to investigate the effect of growth substrates to determine the suitable addition to the substrate to achieve the maximum yield and quality of mushroom fruit body.

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MATERIALS AND METHODS

This research was carried out in the mushroom research laboratory at Al-Qasasin research station, Ismailia Governorate. The research was conducted for two consecutive seasons. 2019 and 2020

The research aims to study the effect of adding some natural supplements to rice straw substrate on the productivity of oyster mushrooms.

As an organic substrate in two growing seasons, the research was carried out for two successive seasons 2019 and 2020

The experiment included ten treatments as follows: rice straw alone - rice straw +coffee waste at (5%, 10% and 15%) - rice straw +Flax seed pea straw at (5%, 10% and 15%) - rice straw +Humic acid at (5%, 10% and 15%) terminal of three concentrations (5,10,15%), the treatments were arranged in a randomized complete block design system with three replicates and each replicate consisted of six white polyethylene bags. Each sachet contains 1 kg dry weight. The dimensions of the bags were 60 cm deep x 40 cm deep and made of 80-micron thick plastic. This experiment was conducted over two seasons that started on November 28 in both seasons 2019 and 2020

Preparation of organic substrate:

Rice straw was cut into particles (4-5 cm) then soaked in tap water for 12 hours and then left to drain excess water which was sterilized in life steam system at 80-90°C for 6 hours after the substrates were left pasteurized to reach room temperature (Zadrazil 1978)

The chemical analysis of the rice straw environment is shown in Table 1,2,3.

Table 1. Chemical Analysis

Treatments	N%	P%	K%	C/N	protein	Carbohydrates
Rice straw	1.29	0.17	0.99	60.02	8.06	43.56

Table 2. Chemical analysis of supplements

Supplements	N%	P%	K%	Protein	O.M%	(C/N)
flax seed	4.10	0.29	1.80	25.66	80.50	18/1
coffee waste	2.21	0.30	2.67	23.66	25.27	20/1

Table 3. Chemical analysis of Humic acid

Analysis	Value
Moisture	15 (%)
Organic matter (dry basis)	80.0 (%)
Humic acid (dry basis)	70 (%)
Heavy elements	2.55 (ppm)
Water solubility	> 98.9 (%)
Appearance	Black flake

Mixing the additives according to the percentage specified on the rice straw environment, then adding the seeds and packing in the bags Spawning.

After the completion of the pasteurization process, the substrate was get out and spread in a thin layer until the temperature reached to 25 ± 3 °C. The substrate was applied into polyethylene bags in four layers (10 cm thick). The spawn material was distributed over each layer at the rate of 5 % (w/w).

Mycelial Growth

The inoculated polyethylene bags were transferred to incubation room at temperature 25 ± 3 °C till full colonization. Then the polyethylene bags were pinned and transferred to the production room, at 20 ± 3 °C with 80 – 90 % a relative humidity by using a foggy system.

Data Recorded:

Mature fruit bodies were picked up at the suitable stage (5 – 7 days intervals) and the following data were recorded:

A- Growth and Yield :

a-Total yield/ bag (gm)

b-Early yield (gm): yield of first flush (in the 15th day Biological efficiency (%) was estimated according to the following equation(Chang *et al*. 1981) ,

c- Fruit body weight (gm).

d-Cap weight (gm

e- Cap diameter (cm).

B. Chemical constituents::

Samples were taken from the clusters of fruit bodies up to 50 (gm)/replicate.

a- Dry matter percentage (D.M. %)

It was determined by drying the samples in an electrical oven at 105 °C till constant weight (A. O. A. C., 1980).

b- Total protein(%)

It was determined as nitrogen content converted to its equivalent protein content by multiplying with 6.25.

c- Total carbohydrates(%)

It was determined following the methods described by (Dubois *et al*. 1956) .

Minerals analysis

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

Statistical Analysis:

The use of the Costat program in statistical analysis

RESULTS AND DISCUSSION

Growth and yield of fruit bodies.

Cap weight.

It is evident from the data in table 4 that, the highest values of cap weight were heavier by growing mushroom on rice straw substrate + humic acid10% in the first and second growing seasons, respectively, followed by rice straw + humic acid 5% in the two growing seasons respectively without significant differences between them. On the other hand, the lowest values of cap weight were recorded when mushrooms were growing using rice straw alone in both seasons respectively. It may be attributed to Humic being a natural chelating substance that helps chelate and facilitate the nutrients in the environment. It turns it into a soft form of the oyster that is easy to absorb and benefit from and works to reduce the C/N ratio and activates enzymes and energy compounds inside plants, which activates the internal cytokinin and increases cell division fiber this is consistent with. Similar results were obtained by Prakash, *et al*. (2010).

Cap diameter

It is clear from the data in Table 4 of these results that the highest values of cap diameter (cm) were heaviest when mushrooms were grown on rice straw substrate +15% humic acid, followed by rice straw +10% humic acid in the first and second growing seasons. With not much difference between them. The lowest values of cover

diameter (cm) were recorded when mushrooms were grown on rice straw alone in the two seasons respectively. This result may be attributed to the same causes mentioned above for humic acid, and these results are consistent with those reported by, Anaem Ascetic *et al*.(2020).

Fruit body weight

Data presented Table 4 of these results that the highest values of average fresh fruit body weight (g) recorded by application of Rice straw +Humic acid10% substrate in the first and second seasons, respectively. On the other hand, the lowest values of mean body weight of fresh fruit were obtained when mushrooms were grown on rice straw alone. This result may be attributed to the same reasons mentioned above for similar results from Humic by Mehdi Dehamradeh *et al.* (2015).

Table 4. Effect of some organic addition to substrate on cap diameter, cap weight and fruit body weight of oyster mushroom

Characters / Treatments	Cap weight (gm)		Cap diameter (cm)		Fresh wight of fruit body (gm)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Rice straw	16.64	17.60	7.8	8.66	22.36	23.65
Rice straw +coffee waste 5%	16.94	19.20	8.60	8.80	23.36	25.45
Rice straw +coffee waste 10%	17.4	19.28	8.80	9.20	23.75	25.63
Rice straw +coffee waste 15%	17.76	19.34	8.80	9.04	24.40	25.89
Rice straw +Flax seed 5%	17.6	19.38	9.20	9.53	23.82	25.73
Rice straw +Falx seed 10%	18.04	19.34	9.20	9.56	24.26	25.49
Rice straw +Flax seed 15%	17.96	19.40	9.00	9.43	24.38	25.86
Rice straw +Humic acid 5%	18.14	19.60	8.48	8.94	24.31	26.12
Rice straw +Humic acid10%	18.16	20.00	9.34	9.84	24.49	26.65
Rice straw +Humic acid 15%	17.65	19.50	9.60	10.20	23.89	26.01
LSD 0.05	0.49	0.57	0.47	0.46	0.63	0.71

Early yield

The highest values of early yield (g) were heaviest when the fungus grew on rice straw substrate + 10% humic acid in the first and second growing seasons, followed by rice straw layer +15% humic acid in the first growing season and rice straw + 5% humic acid in the first growing season. Humic in the second growing season, with no statistically significant differences between them. The lowest values of early yield (g) were recorded when mushrooms were grown using rice straw alone in the first and second growing seasons, respectively. This result may be attributed to the same causes mentioned above for humic acid. This result may be attributed to the same reasons discussed above for similar Humic results by Prakash. and others(2010).

Total yield

It is clear from the organic data in Table 5 of these results that the highest values of the total yield (g) were heaviest on rice straw + 10% humic in the first and second seasons. On the other hand, the lowest values of the total yield were recorded when mushrooms were grown using rice straw alone in the two growing seasons respectively and this result may be attributed to the same reasons mentioned above for humic acid, and this result may be attributed to the same reasons mentioned above for Humic by Karakurt, *et al*. (2009)and Delfine *et al*. (2005).

Table 5. Effect on early yield (gm), total yield (gm) and biological efficiency of oyster mushroom

Characters/ Treatments	Early yield/ bag (gm)		Total yield/ bag (gm)		Biological efficiency (%)	
	1st season	2ndseason	1st season	2nd season	1st season	2nd season
Rice straw	640	613.36	1371.03	1323.46	137.1	132.34
Rice straw +coffee waste 5%	680	710	1491.03	1459.1	149.1	145.91
Rice straw +coffee waste 10%	685	720	1509.7	1476.76	150.97	147.67
Rice straw +coffee waste 15%	689	727	1513.7	1484.1	151.37	148.41
Rice straw +Flax seed 5%	686	725	1513.03	1486.33	151.3	148.64
Rice straw +Falx seed 10%	690	730	1515.7	1501.43	151.57	150.14
Rice straw +Flax seed 15%	695	740	1503.36	1485.76	150.33	148.57
Rice straw +Humic acid 5%	700	749	1506.7	1524.43	150.67	152.44
Rice straw +Humic acid10%	704	750	1554.33	1530.1	155.43	153.01
Rice straw +Humic acid 15%	702	739	1518.33	1496.1	151.833	149.61
LSD 0.05	16.82	18.65	24.40	22.72	4.44	5.47

Biological efficiency(%)

It is clear from the data in Table 5 for these results that the highest values of biological efficiency were the highest values through the growth of the fungus on a substrate of rice straw + 10% humic acid in the first and second seasons. On the other hand, the lowest values of biological efficiency were recorded when mushrooms were grown using rice straw alone in the first and second growing seasons, respectively. This result can be attributed to the same causes mentioned for humic acid. The results obtained are consistent with those obtained by Liu and Cooper (2000). and Liu *et al*. (1996).

Dry matter (%)

It is clear from the data in Table 7 for these results that the highest values of dry matter (%) were heaviest when mushrooms were grown on rice straw substrate + 10% humic acid in the first and second seasons, Rice straw + coffee waste 10% without significant differences between them. On the other hand, the lowest values of dry matter (%) were recorded when mushrooms were grown using rice straw substrate alone (7.4 and 8%) in the first and second growing seasons, respectively. The results obtained are consistent with those obtained by Jerry and Prasad (2007).

Chemical constituents of fruit bodies

The results presented in Table 6 and7 showed that a significant effect of organic addition to the substrate on the chemical components of the fruit bodies. The use of rice straw + humic substrate appears to be the most stimulating treatment for increasing dry matter, nitrogen phosphorous, potassium, and carbohydrate ratios compared to other substrates. On the other hand, the highest values of protein were recordedby growning mushrooms on on rice straw substrate + Coffee in the two growing seasons, respectively. This result may be attributed to the same reasons mentioned above for Humic. The obtained results are in harmony with those obtained by (Sebahattin and Necdet, 2005) and Samavat and Malakooti (2005).

Table 6. Effect of the on the chemical components of the fruit bodies.on N.P.K

Characters/ Treatments	N %		P %		K %	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Rice straw	3.79	3.68	0.77	0.80	1.18	1.15
Rice straw +coffee waste 5%	4.00	4.12	0.79	0.80	1.22	1.32
Rice straw +coffee waste 10%	4.09	4.18	0.82	0.84	1.41	1.44
Rice straw +coffee waste 15%	3.95	4.04	0.82	0.78	1.38	1.33
Rice straw +Flax seed 5%	4.16	4.25	0.84	0.82	1.42	1.43
Rice straw +Falx seed 10%	3.85	4.06	0.82	0.78	1.43	1.30
Rice straw +Flax seed 15%	4.10	3.91	0.80	0.80	1.38	1.32
Rice straw +Humic acid 5%	4.01	4.00	0.88	0.84	1.32	1.40
Rice straw +Humic Humic 10% acid10%	4.30	4.20	0.81	0.80	1.36	1.43
Rice straw ++Humic acid 1.5%	3.89	3.78	0.78	0.80	1.19	1.16
LSD 0.05	0.70	0.98	0.43	0.65	0.69	0.70

Table 7. Effect of protein % , carbohydrate%, and dry matter (%) of oyster mushroom fruits.

Characters/ Treatments	Crude protein (%)		Total carbohydrates (%)		Dry matter (%)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Rice straw	23.68	23.00	40.97	41.61	7.87	8.07
Rice straw +coffee waste 5%	25.00	25.75	41.86	45.08	7.9	8.3
Rice straw +coffee waste 10%	25.56	26.125	45.31	46.34	9.25	9.92
Rice straw +coffee waste 15%	24.68	25.25	44.21	43.67	10.67	11.07
Rice straw +Flax seed 5%	26.00	26.56	43.89	46.01	8.36	9.56
Rice straw +Falx seed 10%	24.06	25.37	45.88	46.01	8.82	08.76
Rice straw +Flax seed 15%	25.62	24.43	45.88	44.34	9.29	9.21
Rice straw +Humic acid 5%	25.06	25.00	44.21	43.33	7.94	9.59
Rice straw +Humic acid10%	26.875	26.25	43.18	47.67	11.35	11.75
Rice straw +Humic acid 15%	24.31	23.62	47.91	41.61	10.25	10.65
LSD 0.05	0.65	0.65	0.61	0.70	1.70	1.70

CONCLUSION

From the above results, it can be recommended The addition of the natural supplements under study to the rice straw substrate in all cases increased the early and total production and improved chemical components of oyster mushrooms, and the best treatments were rice straw + humic acide at 10%, followed by the use of rice straw substrate + humic acide at 5 and 15%.

REFERENCES

A. O. A. C. (1980). Association of Official Agricultural Chemists, officialanalytical chemists, Washington, D. C. 13rd ed.

Ahmed, M. A. (1998). Mushroom and its magic world (in Arabic). Dar El-Maref. 155 pp.

Ahmed, M. A. (1998). Mushroom and its magic world (in Arabic). Dar El-Maref. 155 pp.

Anuradha. J; S. Devyani ; D. Supriya and H. Abhay (2012).The Improvement of Pleuorotus Species Cultivated On Soybean Straw Bed Supplemented with Flax Seed MealInternational Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Impact Factor (2012): 3.358

Bremner, J. M and C. S. Mulvaney (1982). Total nitrogen In: Page, A. L., R. H. Miller, and D. Keeney (Eds). Methods of soil Analysis. Part 2, Amer. Soc. Agron. Madison, W. I. USA pp. 595-624.

Chang, S. T., O. W. Lau, and K. Y. Cho. (1981). The cultivation and nutritional value of *Pleurotus sajor-caju*. Europ. J. App. Microbiol. and Biotechnol., 12-59. (C. F. Hort. Abstr., 52: 11250).

Delfine, S.; R. Tognetti; E. Desiderio and Alvino., (2005). Effect of foliar application of N and humic acids on growth and yield of durum wheat. Agron Sustain. 25,183-191.

Dubois, M. K., A. Gilles, J. Hamillon, P. A. Rebers, and F. Smith. (1956). Colorimetric methods for determination of sugars and related substances. Anal. Chem.. 28. 350.

El-Bagori, M. H., Sh. El-Gremi, M. A. Hassan, and M. E. K. Ibrahim. (1996). Production of mushroom (*Pleurotus* spp.) on agricultural wastes in Kafr El-Sheikh, Egypt. 1st Egypt. Hung. Hort. Conf., Vol. I: 72-83.

Giri, S.K. and Prasad, S., (2007). Drying kinetics and rehydration characteristics of microwave vacuum and convective hot-air dried mushrooms. J Food Engin. 78, 512-521.

Jackson, M. L. (1970). Soil Chemical Analysis. Prentice Hall. Englewood Gilles, N. J.

Juan .C ,C.L,S. Harin , A. Alma , C. Marlene and L. Carmen (2021). Sustainability and Economic Feasibility throughthe Production of Oyster Mushroom (Pleurotus Ostreatus (Jacq.) P. Kumm.) Derived from the Waste of Coffee-Industry: A Case Study in the Western Area of San Salvador, El SalvadorPol. J. Environ. Stud. Vol. 30, No. 6 , 5617-5628

Karakurt, Delfine Y., Unlu, H., Unlu, H. and Padem, H., (2009). The influence of foliar and soil fertilization of humic acid on yield and quality of pepper. Acta Agric. Scandinavica Sec. B Plant Soil Sci. 59(3), 233- 237.

Liu, C. and Cooper, R.J., (2000). Humic substances influence creeping bentgrass growth. Golf Course Manag, 68(10), 49-53.

Liu, C., Cooper, R.J. and Bowman, D.C., (1996). Liu, C. and Cooper, R.J., (2000). Humic acid application affects photosynthesis, root development, and nutrient content of creeping bentgrass. Hort Sci. 33(6), 1023-1025

Mehdi .D, P. Zohreh and A.F. Barat (2015) Effects of Humic and Folic acid on Quantity and Quality Related Traits of Button Mushroom (Agaricus bisporus) Biological Forum – An International Journal 7(1): 823-828.

Mohammed A. Alsanad, N. Youssef , Sassine, E. Zeina & A.F. Sami (2020) Spent coffee grounds influence on Pleurotus ostreatus production, composition, fatty acid profile, and lignocellulose biodegradation capacity Journal of Food, 19:1, 11-20,

Olsen, S. R. and L. E. Sommers (1982). PhoshorusIn: Page, A. L., R. H. Miller, and D. R. Keeney (eds). Methods of Soil Analysis. Part2, Amer. Soc. Agron. Madison, W. I. USA pp. 403-340.

Prakash .P *, S. Anuradha, P. Dhanalakshmi and N. Niveditha(2010) Application of statistical methods to optimize medium for increased yield of Oyster Mushroom (Pleurotus ostreatus) International Journal of Biological Technology (2010) 1(1):66-74.

Samavat, S. and Malakooti, M., (2005). The necessary used of organic acids (Humic and Foloic acid) for additive qualitative and quantitative crops agriculture. Tech J water and soil Res. 463,1-13.

Sebahattin, A. and Necdet, C., (2005). Effects of different levels and application times of humic acid on root and leaf yield and yield components of forage turnip (Brassica rapa L.). Agron J. 4,130-133.

Snedecor, G. W. and W. G. Cochran. (1982). Statistical Methods. 7th ed. Iowa State Univ. Press, Ames. Iowa, U.S.A.

Woon .A , B.Umahsreerekah, B.Vikineswary AND A. Joash (2021) Assessment of coffee waste in formulation of substrate for oyster mushrooms Pleurotus pulmonarius and Pleurotus floridanus Contents lists available at ScienceDirect Future Foods journal homepage: www.elsevier.com/locate/fufo

Zadrazil, F. (1978). The Possibilities of using spent sulphideliqour by cobact in mushroom growing in the production of protein from fungi. Champignon, 163: 23-26.

Zahid, .A, M. Ramzan, M. Amjad Bashir, M. Ahsan Khatana, M. Tahir Akram,S. Nadeem, M. Saad Qureshi, W. Iqbal, M. Umar, S. Walli, R. Muhammad Sabir Tariq, S. Atta, D.A. Al Farraj, M.T. Yassin, (2020), Effect of humic acid enriched cotton waste on growth, nutritional and chemical composition of oyster mushrooms (Pluerotus ostreatus and Lentinus sajor-caju), Journal of King Saud University – Science (2020), doi: https://doi.org/10.1016/j.jksus.2020.08.016

تأثير بعض الإضافات الطبيعية لبيئة قش الارز على إنتاجية عيش الغراب المحارى

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[٢]أقسام بحوث الخضر - معهد بحوث البساتين – مركز البحوث الزراعية

الملخص

تم إجراء هذا البحث لموسمين متتالين في معمل بحوث عيش الغراب، بمحطة بحوث البساتين بالقصاصين، محافظة الإسماعيلية. في الفترة، ٢٠١٩ و٢٠٢٠. و الهدف من التجربة هوعبارة عن دراسة تأثير بعض الإضافات العضوية الطبيعية لبيئة قش الارز على الصفات الطبيعية والكميائية لفطر عيش الغراب المحارى سلاله فلوريدا الصفات التي تم قياسها و رصدها في الجداول (هي قطر الغطاء، وزن الغطاء، وزن الجسم الثمري، المادة الجافة، المحصول المبكر، المحصول الكلى، والمحتوى من النتروجين والفوسفور والبوتاسيوم والمحتوى من الكربوهيدرات والبروتين) لفطر عيش الغراب سلالة فلوريدا لقد أوضحت النتائج وجود فروق معنوية في كل الصفات تحت الدراسة، فأستخدام بيئة قش الأرز مع الهيومك أعطى أعلى القيم لمعظم صفات المحصول والصفات الكميائية (المادة الجافه والنيتروجين والفسفور والبوتاسيوم والكربوهيدرات)، فيما يتعلق بالصفات الكميائية للأجسام الثمرية , للمادة الجافة لفطر عيش الغراب والمحتوى من الفوسفور والبوتاسيوم والنيتروجين والكربوهيدرات، في حين أن بيئة قش الأرز مع الكافيين أعطت أعلى القيم في البروتين.وعموما تعتبر بيئة قش الأرز مع الهيومك أفضل لانتاج فطر عيش الغراب المحارى سلاله فلوريدا مقارنة بالاضافات الأخرى (مخلفات البن ومخلفات بذور الكتان) المضافه لبيئة قش الأرز قيد الدراسة.التوصيه من النتائج المذكورة أعلاه ، يمكن التوصية به أدت إضافة المكملات الطبيعية قيد الدراسة إلى ركيزة قش الأرز في جميع الحالات إلى زيادة الإنتاج المبكر والإجمالي وتحسين المكونات الكيميائية لفطر المحار ، وكانت أفضل العلاجات هي قش الأرز + أسد الدبالية بنسبة ١٠٪ ، يليها استخدام الأرز طبقة من القش + الدبالية بنسبة ٥ و ١٥٪.