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YIELD AND FRUIT QUALITY OF OYSTER MUSHROOM CULTIVATED ON SOME DIFFERENT AGRICULTURAL WASTES AND MATERIALS

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ABSTRACT : ***In this study six agricultural wastes and organic substances differe in their sort were evaluated to their ability for growing and production of Oyster mushroom, (Pleurotus ostreatus No.14) . These substrates (media) were hay clover, rice straw, wheat straw, maize straw, sugarcane bagasse and sweet potato vine. Mashroom production, quality of fruit body and its chemical constituents were determined .***

Growing mushroom on sweet potato vine gave the highest values of total yield, early yield (yield of first flush), fruit number, biological efficiency, caps weight, potassium content, ash content and 2nd highest protein content . Using rice straw, wheat straw and maize straw substrates, gave a good yield and satisfied fruit quality. Although using hay clover and sugarcane bagasse as growing substrates gave the lowest fruit yield, hay clover gave the highest protein content, total free amino acids, dry matter and second highest content of ash .

In general, we recommend using rice straw as a substrate (media) for growing Oyster mushroom because it produced the 2nd highest yield, and good fruit quality in this experiment besides it is cheap in price and easy in transportation .

In addition, using up rice straw in mushroom production may help in reducing its accumulation in the field, which subsequently reduces pollution of the environment .

Key words: ***Oyster mushroom, cultivation subustrates, yield of fruit bodies, biological efficiency, quality of fruit bodies, nutritional value.***

INTRODUCTION

The use of mushrooms as human food, dates back to antiquity. In ancient cultures such as the Egyptian, Indian, Greek and Roman, mushrooms have been described as sophisticated delicacies associated with Royal class . Today with the development of better technologies and greater realization of their nutrient and medicinal values besides its culinary appeal, mushrooms have come to occupy an important place in food habits of people in several parts of the world .

With all their historical background and nutritive importance, it is unfortunate that in Egypt, mushrooms have not caught the imagination of the

public at large to become an important food item . Perhaps the reasons for their not being taken up widely is their non-availability at low prices for the common man and also due to lack of knowledge of their nutritional value .

Oyster mushrooms (*Pleurotus species*) are a good choice for beginning mushrooms cultivators because they are easier to grow than many of the other species, and they can be grown on a small scale with a moderate initial investment. They grow well on a range of agricultural waste products (high-cellulose materials).

Some of these materials do not require sterilization, only pasteurization, which is less expensive. Mushroom production can play an important role in managing farm organic wastes in a way to extract value from waste materials, otherwise these wastes would be burn and subsequently contaminated the environment. Thus, oyster mushroom can become an integral part of a sustainable agriculture system. Many types of organic wastes produced from crop production or the food processing industry can be used to support oyster mushroom production .

Among different organic substrates paddy (rice) and wheat straw, cotton waste, maize cobs, waste paper and cotton stalks are all suitable for high production capacity of oyster mushroom (Marimuthu,1995) . In addition raw bagasse is considered a practical and economic substrate (Castillo,1996) .

The objectives of this work was to evaluate different sorts of substrates used in cultivation oyster mushroom to their: 1) fruit yield, 2) quality of fruits, 3) chemical constituents of fruits and 4) the most benefit gain, in terms of economic costs and environmental advantage.

MATERIALS AND METHODS

This experiment was carried out in the Mushroom Research Unit in the Faculty of Agriculture, Minufiya University in two successive years (winter seasons) . Oyster mushrooms strain *Pleurotus ostreatus* No. 14 (provided from Ministry of Agriculture, Mushroom Research and Production Unit) was used in this study. Six organic substances (Table 1) differ in their sort and chemical constituents were evaluated to their ability for growing and production of oyster mushroom.

Substrate pretreatment :

The substrates used were wheat straw, rice straw, sugarcane bagasse, maize straw, hay clover and vine of sweet potato. The substrates were chopped before using and then soaked in tap water for 12 hours (over night). The substrates were then pasteurized in a boiler at 90°C for 4 hr. according to the method described by Leong (1980). The substrates were left to cool and dry at room temperature until moisture content reached to about 70% (Zadrazil,1978) .

Table (1): Chemical analysis of some important compounds in the the substrates used.

Characters / Substrates	Nitrogen (%)	Protein (%)	Phosphorus (%)	Potassium (%)	Total charbohyd-rates (%)
Hay clover	2.61	16.3	0.26	3.5	19.8
Rice straw	0.64	4.00	0.21	3.1	17.5
Wheat straw	0.74	5.25	0.23	2.7	16.3
Maize straw	0.57	3.56	0.24	2.3	18.31
Sugarcane bagasse	0.37	2.31	0.26	3.1	33.2
Sweet potato vine	2.76	17.25	0.26	3.3	25.2

Substrate inoculation :

The substrates were mixed with the spawn at 4% on wet weight basis (the spawn was prepared according to the method described by Chang, (1982). In addition, wheat bran at 5% on dry weight basis was also applied. The previous mixture was pressed in transparent and perforated (about 10 small holes) plastic bags (30 x 50 cm). The bags were kept in dark incubation room at 25 ± 2 °C till dense growth of mycelium (for about 2-3 weeks).

Induction of fruit bodies :

After full mycelium growth (spawn run), the environmental conditions were changed to induce fruit bodies formation, the bags were exposed to light by white florescent lamps after removing their tops . Aeration was kept up to ensure a constant temperature and humidity throughout the growing period, the relative humidity in the growing room was 80-90% and the temperature was maintained at 22 ± 2 °C.

Harvesting :

Mushroom fruit bodies were harvested when reached maturity, at which the fruit bodies start to " curl up" . At this stage, the fruit bodies were twisted and picked up.

Each substrate (treatment) was represented by 8 containers (bags) and every two bags made together a one replicate. A randomized complete block design with four replications was used. All data were statistically analized following the procedure outlined by Steel and Torrie (1980). Combined analysis were carried out only for physical and chemical constituents of fruit bodies of both years (Snedecor and Cochran, 1967).

Data recorded :

1. Yield and its components :

A) Early and total yields: the early yield was calculated as the yield of fruit bodies which harvested during the first 15 days from fruit bodies initiation (1st flush) , the medium yield was that obtained during the period between 16- 30 days (2nd flush) while the late yield was collected between 31- 45 days after fruit body initiation (3rd flush) . The total yield was the sum of all harvestings.

B) Biological efficiency (B. E.) was estimated according to the following equation (Chang *et al.,* 1981):

$$\text{B. E.} = \frac{fresh\ \ weight\ \ of\ \ total\ \ yield}{weight\ \ of\ \ dry\ \ substrate} x100$$

C) Fruits number : number of fruits produced throughout the harvesting season.

D) Number of days from spawning to the first flush initiation (fruiting).

2. Quality of fruit bodies *:*

A) Physical characters :

1. Weight (g) and diameter (cm) of caps:
Cap weight: caps were separated from the stem and the average weight was recorded in each harvest.
2. Weight (g), length (cm) and width (mm) of the stems (stipes).
3. Average of fruit weight (g) .
4. Cap / fruit body ratio (by weight).

B) Chemical constituents :

Samples were taken from the edible parts (caps) of the fruit bodies from each of the 4 replications. The samples were dried at 70ºC and kept for chemical analysis. The following chemical constituents were determined:

1. Dry matter: Dry matter (%) content was determined by drying subsamples in an oven at 105ºC till constant weight.

2. **Ash: The ash content was determined according to the official method (A.O.A.C., 1980), by burning the sample in an electric muffle furnace at 550ºC. (until the residue was white or nearly so), then cooled in a desiccator and weighed.**
3. **Crude fibre: The crude fibre content was determined according to the method described by A.O.A.C. (1965) .**
4. **Crude protein: Protein content in caps was determined by multiplying the nitrogen content by 6.25 as described by Pregl(1945).**
5. **Total carbohydrates : Total carbohydrates were determined according to the method described by Smith *et al*. (1956).**
6. **Total free amino acids : Total free amino acids content of caps was determined using the colorimetric method described by Sadasivam and Manickam (1992)**
7. **Mineral determinations :**

- **Nitrogen : Total nitrogen content of caps was determined by using the microkjeldal apparatus as described by Peach and Tracey (1956).**
- **Phosphorus : Phosphorus content in caps was determined by using the colorimetric method described by Murphy and Riley (1962).**
- **Potassium : Potassium content in caps was determined by using flame photometer according to Brown and Lilliland (1946) .**
- **Zinc and Copper in caps were determined by using the atomic absorption spectrophotometer (Model 3300), according to the methods described in A.O.A.C. (1980).**

RESULTS

1- Yield and its components :

Cultivation mushroom on sweet potato vine gave the highest total yield among all substrates used (Table 2 and Fig.1)). Cultivation on rice straw, maize straw (Fig. 2) and wheat straw gave less yield. However, using sugarcane bagasse (Fig. 3) and hay clover produced the lowest fruit yield (Table,2). The response of early yield to cultivation on such substances almost followed the same trend as with total yield. But ratio of early yield (yield harvested during the 1^{st} flush) to total yield varied considerably by using different substrates . Early yield x 100 / total yield was the highest i.e., 90.72 % (average of the two seasons) with hay clover and was the lowest i.e., 52.14% (average of the two seasons) with maize straw. The high ratio means that some growing substrates (such as hay clover) gave most mushroom fruits in the 1^{st} flush, however, substances such as maize and wheat straws gave about 50% of total yield in the 1^{st} flush and the other 50 % produced throughout the other 2 flushes, which subsequently prolonged the harvesting period.

As expected biological efficiency (B.E.) which is total fruit yield x 100 / dry weight of the substrate which reflect the conversion efficiency of each weight unit of the substrate into mushroom fruit bodies. B.E. was quite highest i.e., 95.5% (average of the 2 seasons) when sweet- potato vine was used. Using rice straw, maize straw and wheat straw also gave good B.E. being respectively 82.8, 80.2 and 77.6% (average of the two years) however, sugarcane bagasse and hay clover gave lowest B.E. , these were 61.6 and 51.0% (average of the 2 years) respectively.

Number of days from spawning to fruit production of the 1st flush, reflected the ability of the substrate to induce rapid and intense mushroom mycelium growth, from cultivation (spawning) to fruit bodies initiation. Although, mycelium growth during such period take a range of 33.40 - 36.12 days (average of the 2 years) in most growing sabstrates, it take only 26.3 and 28.1 days when mushroom was grown on hay clover and sweet potato vine, respectively.

Table (2): Effect of sort of substrate on mushroom total and early yield, biological efficiency (B.E.), and the number of days from spawning to 1st flush in first and second seasons.

Characters / Substrates	*Total yield (g)	**Early yield (g)	B.E. (%)	No. of days from spawning to 1st flush	*Total yield (g)	**Early yield (g)	B.E. (%)	No. of days from spawning to 1st flush
	1st season				2nd season			
Hay clover	766.56	741.78	51.10	26.50	763.02	645.86	50.87	26.00
Rice straw	1129.28	739.77	75.28	34.50	1355.81	845.13	90.39	37.25
Wheat straw	1075.66	492.88	71.71	31.75	1250.88	757.94	83.39	36.75
Maize straw	1125.94	652.87	75.06	31.50	1280.23	601.79	85.35	35.25
Sugarcane bagasse	937.74	599.64	62.52	35.50	911.49	507.00	60.77	36.75
Sweet potato vine	1409.75	1056.33	93.98	27.50	1426.44	1166.75	95.10	28.75
L.S.D. at 0.05 level	158.97	125.61	10.60	4.80	104.56	197.57	6.97	6.10

*** Total yield = Yield/bag (1.5 kg dry wt substrate)**
**** Early yield = fruit weight of 1st flush**

2- Fruit quality :

A- Physical proprieties

Fruit number and average fruit weight varied according to the substrate sort used in growing mushroom (Table 3). Maize straw substrate followed by wheat straw and rice straw gave the heaviest fruit body. On the other hand, sweet potato vine followed by hay clover, gave the, lightest fruit body.

Table (3): Effect of sort of substrate on fruit number and average weight of fruit body, caps and stipes*.

Characters / Substrates	Fruit number	** Average weight of fruit body (g)	** Average weight of cap (g)	** Average weight of stipes (g)
Hay clover	79.38	11.21	8.39	2.55
Rice straw	92.50	16.11	10.60	5.37
Wheat straw	78.33	16.40	11.07	5.25
Maize straw	75.95	16.72	11.01	5.72
Sugarcane bagasse	63.12	15.11	10.06	5.03
Sweet potato vine	123.12	12.64	8.96	3.62
L.S.D. at 0.05 level	24.0	1.8	1.6	1.03

*** Values present in the table are those of the combined analysis of the two seasons.**
****Average of the measurements taken during the harvesting season.**

Fruit number however , was highest (123.12) when sweat potato vine substrate was used in cultivation oyster mushroom, followed by rice straw (92.5). Fruit number produced as a result of using hay clover, wheat straw and maize straw as substrates ranged from 79.38 to 75.95. However, growing mushroom on sugarcane bagasse gave the lowest number of fuits (63.12).

Average weight of caps (edible part) as well as weight of stipes followed almost the same trend as with average weight of fruit body, i.e., maize, wheat and rice straws gave the highest weights, followed in descending order, by sugarcane bagasse, sweet potato vine and hay clover.

Although, average fruit weight produced by using hay clover and sweet potato vine were light comparable to those produced by other substrates, the ratio of cap weight to fruit weight (%) was highest when both substrates in particular were used (data not shown). In addition, cap diameter and stem (stipe) width and length were not significantly affected by using any of these substrates (data not shown).

B- Chemical properties and nutritional value :

1- Crude protein and total free amino acids contents:

Data present in Table (4) clearly shows that crude protein in fruit bodies varied according to substrates used and also between time of harvesting i.e, at the 1st , 2nd and 3rd flushes . In general, crude protein was highest in fruit bodies that were grown on hay clover substrate whatever was the time of harvesting.

Table (4): Effect of sort of substrate on crude protein content of mushroom fruits produced in different stages as well as total free amino acids*.

Characters / Substrates	Crude protein (%) on dry weight basis			**Total free amino acids (mg/g)
	First flush	Second flush	Third flush	
Hay clover	29.54	41.46	32.38	64.38
Rice straw	21.77	22.97	22.97	15.96
Wheat straw	17.61	21.88	23.91	18.24
Maize straw	22.42	26.69	26.04	24.31
Sugarcane bagasse	21.12	21.77	22.32	29.17
Sweet potato vine	23.91	32.60	26.04	21.67
L.S.D. at 0.05 level	2.84	2.86	2.24	2.40

*** Values present in the table are those of the combined analysis of the two seasons.**

****The data of amino acids content represent the average of measurements taken during the harvesting season.**

Also, growing mushroom on sweet potato vine followed by maize straw gave fruit bodies contained high percentage of crude protein, in the three times of harvesting. Other substrates such as rice straw, wheat straw and sugarcane bagasse produced fruit bodies with lower crude protein (comparing with the above mentioned substrates).

It is obvious also from data in Table (4) that crude protein in fruit bodies harvested during the 1st flush (during the 15 days from fruiting initiation) was at minimum. Then crude protein increased to the maximum in the 2nd flush (16-30 days from fruit initiation) and then decreased again but to intermediate level in the 3rd flush (31-45 days from fruit initiation).

Regarding total free amino acids, fruit bodies that produced from hay clover had striking highest content (64.4 mg/g) of such acids (Table, 4) and fruit bodies produced by other substrates contained only a rang between 29.2 mg/g (produced by sugarcane bagasse) to 16.0 mg/g (produced by rice straw).

2- Total carbohydrates, crude fibres, dry matter and ash contents :

It is clear from Table (5) that fruit bodies grown on maize straw, wheat straw and sugarcane bagasse had significantly highest total carbohydrate content (ranged from 41.7 to 40.40%). However, fruit bodies grown on rice straw and sweet potato vine had an intermediate content of carbohydrates being 33.8 and 32.4% respectively. Hay clover, on the other hand, produced fruits with significantly lowest total carbohydrates (20%).

Crud fiber content in fruit bodies was not significantly affect by cultivation mushroom on any of the substrates used.

Regarding dry matter contents, the data in table (5) reveal that both hay clover and sweet potato vine produced fruit bodies that had significantly highest dry matter content than that produced by other substrates being 9.0 and 8.9% respectively . Almost similar (differences were not significant) contents of dry matter was detected in fruit bodies produced by rice, wheat and maize straws as well as sugarcane bagasse.

Ash content in fruit bodies produced by growing mushroom on sugarcane bagasse (7.0 %) hay clover (6.9 %) and sweet potato vine (6.6 %) were significantly higher than in those produced by rice, (5.7 %) wheat (5.9 %) and maize (5.7 %) straws.

Table (5): Effect of sort of substrate on total carbohydrates, crude fibres, dry matter and ash contents of mushroom fruits* .

Characters / Substrates	** Total carbohydrates (%)	** Crude fibres (%)	** Dry matter (%)	** Ash (%)
Hay clover	19.97	4.89	9.00	6.86
Rice straw	33.84	5.38	7.32	5.72
Wheat straw	40.47	5.58	7.86	5.92
Maize straw	41.66	4.83	7.53	5.73
Sugarcane bagasse	40.44	4.85	7.02	6.96
Sweet potato vine	32.42	5.19	8.89	6.61
L.S.D. at 0.05 level	5.39	N.S.	0.94	0.47

*** Values present in the table are those of the combined analysis of the two seasons.**
****The data represent the average contents of these constituents determined throughout the harvesting season.**

3- Mineral contents :

Data present in Table (6) clearly shows that fruit bodies produced on hay clover substrate had the highest content from nitrogen, zinc and copper. Also, phosphorus and potassium contents in such fruit bodies rank the 2nd and the 3rd , respectively, among fruit bodies grown on other substrates. In addition, fruit bodies grown on sweet potato vine showed the second highest content of nitrogen, zinc and copper while contained the highest potassium content. Also, with few exceptions, maize straw, sugarcane bagasse, rice straw and wheat straw produced fruit bodies with either intermediate or low mineral contents.

Table (6): Effect of sort of substrate on nitrogen, phosphorus, potassium, zinc and copper contents (on dry weight basis) of mushroom fruits* .

Characters / Substrates	**Nitrogen (%)	**Phosphorus (%)	**Potassium (%)	** Zinc (ppm)	**Copper (ppm)
Hay clover	5.73	1.13	1.19	146.14	88.01
Rice straw	3.62	0.96	1.15	113.49	73.20
Wheat straw	3.39	0.94	0.98	124.22	73.96
Maize straw	4.01	1.06	0.96	132.94	73.12
Sugarcane bagasse	3.48	1.24	1.24	99.67	78.00
Sweet potato vine	4.46	1.02	1.32	136.90	80.91
L.S.D. at 0.05 level	0.25	0.07	0.13	35.32	8.00

*** Values present in the table are those of the combined analysis of the two seasons.**
**** The data represent the average contents of these constituents throughout the harvesting season.**

DISSCUSION AND CONCLUSION

The obvious variation in mushroom yield, biological efficiency and properties of the fruit bodies produced by different substrates were mainly due to variation in physical and chemical characters of each substrate. It is well known that fungus require in their nutrition several elements; such as carbon which is present in organic compounds particular charbohydrates which provide for both the structural and energy requirements for fungal cell, nitrogen which is essential in the synthesis of proteins and other nitrogen compounds. Also, other mineral elements as sulfur, phosphorus, potassium, magnesium, iron and etc., are all needed by fungus. In addition vitamin B and lipids are also required. Moreover, the physical factors of the substrate such as keeping moisture, aeration, pH and viscosity could affecting growth and fruiting of mushroom. Thus, the variation in yield, fruit quality and chemical contents of fruit bodies produced by cultivation on different substrates could be then explaine.

It is worth to mention that the fungi prefer carbohydrates as a food source, with proteins as second source .

Although hay clover substrate produced the lowest fruit yield the high rate of vegetative growth (mycelial growth) expresed by fewer days from spawning to 1st flush initiation observed when this particular substrate used indicates that conditions considered suitable for mycelial growth may not be the best for fruiting. In this respect a carpon source such as hexose's are better than polysaccharides for mycelial growth, but the opposite may be true for mushroom production (Van Griensven 1988). Moreover, the optimal pH values and adequate aeration for fruiting may differ from those required for mycelial growth.

The highest yield, and highest number of fruit bodies as well as the highest conversion efficiency obtained (Table 2) by cultivation mushroom on sweet potato vine were mainly due to its high content of both carbohydrate and protein. The high nutritional value of sweet potato vine i.e., total carbohydrates up to 35.0 % (Salem,1999) and protein up to 17.5- 19.3% (Salem, 1999 and Wang , 1982) was also reported.

The successful cultivation of oyster mushroom on rice straw, wheat straw and maize straw (Fig. 2) were also found by Das *et al*., (1987). Also, Park *et al*., (1975) came to the same result, which obtained in this study, that yield produced by cultivation *P. ostreatus* mushroom on rice straw was slightly higher than that cultivated on wheat straw. The high average weight of fruit body produced by cultivation mushroom on rice straw, wheat straw and maize straw were also reported by Farrag (1993). In addition, more recently, Radwan (2005) came to a conclusion that rice straw was the best substrate for oyster mushroom cultivation because it gave the highest fruit yield among eight other substrates that were evaluated. In this respect it was also mentioned (Van Griensven 1988) that Oyster mushroom are primary decomposers; the first organisms which to colonize plant raw materials by

breaking down cellulose and lignin. Such organic materials are rich in plants particularly in straw of cereal crops.

The chemical analysis of the substrates used in this study present in Table (1) only could not explain, in some cases, the differences in yield and in fruit quality produced by cultivation mushroom on such substrates. For further elucidation, hay clover show high nutritional value (high protein and high charbohydrates) but it however gave low yield. Also, although rice, wheat and maize straws had a moderate nutritional value they gave good yield. This may suggests that rather than the protein and charbohydrates contents of the substrates, the forms of these compounds and the degree of their availability to the fungi and the presence of some compounds which may affect the food metabolism, all besides the physical properties of the substrate could significantly affect mushroom productivity.

Sugarcane bagasse (as an example) may contain high content of carbohydrates (particularly in sucrose form) but it may not contain sufficient nitrogen, which adversely effect metabolic balance. This may explain the low yield observed with this particular substrate (Table 2 and Fig. 3). Also the low yield obtained by using hay clover could be explained in the light of the findings of Muller- Hrvey and McAllen (1992) who reported that forage legumes can contain high levels of tannins particulrly condensed tannins that can has negative effect on protein and carbohydrates digestibility this may responsible for the lowest yield produced by growing mushroom on such material.

Although, sweet potato vine had high nutritional value, it produced however the 2nd lowest average weight of fruit body, this may be due to the competition of the large number of fruits (the highest number of fruits i.e., 123.12 per experimental unit) on the surface space of the substrate (Fig. 1).

The differences in chemical contents observed between fruit bodies produced on different substrates were excepted as such substrates differ in their physical properties and chemical constitutes. Bisaria et al., (1987) concluded that the content of a particular element in the fruit bodies of *Pleurotus* mushroom was found to be higher when cultivated on a substrate containing higher concentrations of that element .

We recommend using rice straw as a substrate for growing oyster mushroom because: rice straw gave the 2nd highest yield in this study, it was the cheapest substrate (at least among the six substrates used in this experiment) and is easy in transportation. In addition, using rice straw in growing mushroom may help in reducing its accumulation in the fields in a way subsequently reduces the pollution of the environment.

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المحصول وصفات الجودة لعيش الغراب المحاري النامي علي بعض المخلفات والمواد الزراعية المختلفة

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الملخص العربي

يعتبر عيش الغراب أحد المصادر النباتية للبروتين والأحماض الأمينية الأساسية اللازمة للإنسان وبالإضافة إلى أهميته الغذائية والطبية فزراعة عيش الغراب تعتبر أحد المشروعات الاقتصادية الهامة التى يمكن تنفيذها بسهولة وبرأس مال قليل خصوصا عند زراعة عيش الغراب المحارى . أيضا يزرع عيش الغراب على المخلفات النباتية المختلفة للمزرعة وهذا يؤدى الى استهلاك هذه المخلفات وعدم تراكمها بطريقة تؤدى إلى تلوث للبيئة.

فى هذه التجربة تم استخدام سته أنواع من المخلفات الزراعية والمركبات العضوية تختلف فى مصادرها النباتية وذلك لمقارنتها من حيث قدرتها علي إنتاج عيش الغراب المحارى (***Pleurotus ostreatus*** **No. 14**) هذه البيئات هي دريس البرسيم ، قس الأرز ،قش القمح،قش الذرة، مصاصة القصب وعرش البطاطا. وقد تم تقدير المحصول الكلى والمبكر وصفات الجودة والقيمة الغذائية للأجسام الثمرية الناتجة من كل بيئة من بيئات الزراعة.

ولقد أظهرت النتائج ان زراعة عيش الغراب على بيئة عرش البطاطا أعطى أعلى محصول كلى ومحصول مبكر (محصول الدفعة الأولى) وأعلى عدد للأجسام الثمرية وأعلى قيمة للكفاءة البيولوجية ووزن القبعة ومحتوى الثمار من البوتاسيوم والرماد كما أعطت ثاني أعلى قيمة من محتوى الثمار من البروتين .

كما أدى زراعة عيش الغراب على قش الأرز وقش القمح وقش الذرة علي التوالي الى إعطاء محصول جيد وبصفات ثمرية جيدة . وبالرغم من ان محصول عيش الغراب النامي على كل من دريس البرسيم ومصاصة القصب كان أقل محصول تم الحصول عليه إلا أن زراعة عيش الغراب

علـى دريـس البرسـيم أعطـت ثمـار ذات أعلـى محتـوى مـن البـروتين والأحمـاض الأمينيـة الكليـة والمادة الجافة وثاني أعلى محتوى من الرماد .

وبصـفة عامـة يمكـن التوصـية باسـتعمال قـش الأرز فـي زراعـة عيش الغراب المحـارى وذلـك لكونـه يعطـى محصـول مرتفـع مـن الثمـار (ثـاني أعلـى محصـول فـي هذه الدراسـة) ولأن صـفات الثمـار الناتجـة جيدة ولـرخص ثمنـه وسـهولة نقلـه . هذا بالإضـافة إلا أن اسـتهلاك قدرا مـن قـش الأرز فـى زراعة عيش الغراب يساعد في تقليل الكميات المتراكمة منـه فـي الحقـول ممـا يـؤدى إلـى التقليل من تلوث البيئـة .