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EFFECT OF OYSTER MUSHROOM GROWTH ON CHEMICAL COMPOSITION AND IN-VITRO DISAPPEARANCE OF FARM WASTES PREVIOUSLY FORTIFIED BY OIL SEED CAKES

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SUMMARY

The present work was carried out to investigate the improvement of the chemical structure of the agricultural wastes by supplementation with oil seed cakes during the oyster mushroom(*Pleurotus colmbinus and Pleurotus ostreatus*) to be used as animal feed for small ruminants . This experiment was carried out in the Regional Centre for Food and Feed (RCFF) belong to Agricultural Research Center, Ministry of Agriculture. winter 2005 using *Pleurotus sp.* (obtained from DSMZ institute, Germany, whereas the spawn prepared by RCFF. Two and half kg from chopped wet and pasteurized supplemented rice straw and supplemented sesame with 3% oil seed cakes (soybean seed cakes. cotton seed cakes and. sunflower seed cakes mixed with 3% calcium carbonate with 65 % moisture content) were inoculated in each plastic container (40 ×25 × 30 cm) with a 5% (wt/wet wt) spawn. The containers were covered tightly with plastic sheets and incubated up to 4 weeks.

Samples were taken after 4 weeks to determine the chemical changes of substrates. Crude protein. Ash content. lignin. cellulose and hemicellulose were determined. In vitro dry matter digestibility was carried out.

Concerning the chemical composition. many changes in rice straw and sesame straw chemical composition took place due to the fungal growth and supplementation during the incubation periods. Soybean seed cakes with *Pleurotus columbinus* increased the protein content in rice straw and sesame straw. by 237% and 229% respectively after four weeks of incubation. In the same time. the highest improvement in the crude fiber was occurred when supplemented the rice straw with soybean seed cake 3% and incubated with *Pleurotus ostreatus and Pleurotus columbines* 34.9%. without differences between the two treatments. Concerning the sesame straw results did not exert detrimental high effect in the crude fiber comparing with incubated sesame straw without supplementation. The highest decreasing in the fiber content was noticed with sesame straw supplemented with soybean when cultivated with both fungus 17.2%.

Concerning the fiber fraction, NDF content have been improved clearly in supplemented rice straw and sesame straw by soybean cakes when incubated with *Pleurotus ostreatus* for 4 weeks. On the other hand, the effect of treatments on the fiber fractions content, there is a clearly improvement in supplemented rice straw and sesame straw by soybean when incubated with *Pleurotus ostreatus* for 4 weeks.

Concerning cellulose and hemicellulose, supplemented rice straw with sunflower seed cakes and soybean seed cakes showed the greatest improvement for cellulose and hemicelluloses during incubation period (4 weeks) with *Pleurotus sp.* Whereas, regarding the sesame straw, no high improvement was noticed through all treatments. Concerning the degradation of lignin content, the highest degradation for rice straw and sesame straw was observed when rice straw incubated with *Pleurotus ostreatus* and sesame straw supplemented with soybean incubated with *Pleurotus columbines*. Beside that, the In-vitro OMD and In-vitro DMD for rice straw and sesame straw were increased. The highest increasement were shown with these substances when supplemented with soybean incubated for 4 weeks with *Pleurotus columbinus*

Keywords: chemical composition, agricultural wastes, oil seed cakes, oyster mushroom

INTRODUCTION

The use of crop residues as growing media in oyster mushroom (*Pleurotus spp.*) production in Egypt is reviewed. *Pleurotus* has high potential because of low cost production technology, the possibility for direct use of agro wastes and the suitability of the climate.

Growing population coupled with a significant decrease in grain production in Africa is responsible for increasing numbers of people being in sufficiently fed. Most African countries which depended on agriculture for food and income, produce rice, wheat, maize, sugarcane, cotton and other fiber reach crops.

There crops yield large quantities of lignocelluloses residues. Although some of there residues are used as animal feed, much is wasted or burnet. There is a way of converting this material to protein suitable for human and animal consumption (Eicker, 1993) also reported that, oyster mushroom is a basidomycetes fungus cultivated a commercial scale for its edible fruiting bodies of pleasant flavor and characteristic biting texture

Beside that mushroom fruit bodies is rich in protein, vitamins, minerals and fiber. Also, the fruiting bodies remaining after the last harvest were used as a source of protein for feeding dairy cattle and sheep (Lazonal 1990) and (Zadrazil and Dube 1992). Beside that, Gheyasuddin *et al.*, 1970 reported that oil seed meals is free from toxic compound and antinutritional factors.

Concerning the supplementations treatments Zakia *et al.*, 1993, and Chen *et al.*, 2001 reported that, supplementation the rice straw and corn stalks with powdered oil seed cakes (mustard, Niger, sunflower, cotton and Soya bean) and inoculated with mushroom *(Pleurotus spp.)* increased the mushroom yield 50 and 100%, compared to the unsupplemented substrate. Oil seed cake supplementation also led to an increase in the solubility of the rice straw substrate, there was an increase in the contents of free sugars and amino acids and decrease in cellulose and hemicelluloses. Correspondingly, there was also increase in the activities of carboxymethylcellulase, hemicellulase and protease. In-vitro dry matter indicated a significant increase over that of the spent straw derived from the unsupplementated lot.

Cellulase and hemicellulase showed a rise in their activities in the rice straw substrate, after the spawn run and especially after cropping, in the oil seed cake supplemented substrates. In-vitro dry matter enzymatic digestibility (IVDMED) increased in the spent straw substrate supplemented with Soya bean compared to unsupplemented substrate. Oil seed cake supplementation caused increased secretions of the degradation enzymes coupled with an increased production of mushroom fruiting bodies.

MATERIALS AND METHODS

This experiment was carried out in the Regional Centre for Food and Feed (RCFF) belong to Agricultural Research Center. Ministry of Agriculture, winter 2005.

Fungi

Pleurotus columbinus and *Pleurotus ostreatus* were used in the present work. The culture was obtained from DSMZ Institute, Germany. Whereas the spawn prepared by RCFF.

Agricultural by-products

Two different types of low quality roughages were used in this investigation sesame straw and rice straw. They were obtained from fields belongs to the Agriculture Research Centre, Giza. The substrates (sesame and rice straw) were sun dried and chopped to lengths of 3-6cm.

Supplementary Materials

The three supplementary materials used in this study were sunflower seed cakes, soybean seed cakes and cotton seed cakes. The supplementary materials were added at a rate of 3% from substrates (sesame straw or rice straw).

Preparing the substrates

Chopped substrates were soaked in tap water for 24 hours until moisture content reached 60-70%. Three percent from supplementary materials were added (w/dry wt of substrate) to the chopped substrates (sesame straw or rice straw). Calcium Carbonate 3% (w/dry w) was used to adjust the pH. The mixed substrates (substrate + 3% Soya bean or substrate +3% Sunflower or substrate + 3% cotton seed with 3 % Calcium Carbonate) was soaked in boiled water (800Cm/kg) until the temperature reached room temperature to minimize the fungus and bacteria diseases.

Inoculation of substrates

The substrates (sesame straw or rice straw) were cooled at room temperature and spread in one layer (15 cm thick) into plastic containers (40x 25 x 30 cm). The spawn was distributed over the substrate at rate of 5 % (w/w). A five cm thick layer of substrate was added to cover the spawn. Totally amount of substrate used was 2.5 kg for each container.

Experimental rations:

The experimental treatments were formulated as following:

T1= Raw rice straw
T2= Rice straw treated with *Pleurotus ostreatus*
T3= Rice straw treated with *Pleurotus columbinus*
T4= Raw rice straw + 3% soya bean cake
T5=Rice straw + 3% soya bean seed cake + *Pleurotus ostreatus*
T6= Rice straw + 3% soya bean seed cake + *Pleurotus columbinus*
T7= Raw rice straw + 3% cotton seed cake
T8= Rice straw + 3% cotton seed cake + *Pleurotus ostreatus*
T9= Rice straw + 3% cotton seed cake + *Pleurotus columbinus*
T10= Raw rice straw + 3% sunflower cake
T11=Rice straw + 3% sunflower seed cake + *Pleurotus ostreatus*
T12=Rice straw + #% sunflower seed cake + *Pleurotus columbinus*
T13= Raw sesame straw
T14= Sesame straw treated with *Pleurotus ostreatus*
T15= Sesame straw treated with *Pleurotus columbinus*
T16= Raw sesame straw + 3% soya bean seed cake
T17= Sesame straw + 3% soya bean seed cake + *Pleurotus ostreatus*
T18= Sesame straw + 3% soya bean seed cake + *Pleurotus columbinus*
T19= Raw sesame straw + 3% cotton seed cake
T20= Sesame straw + 3% cotton seed cake + *Pleurotus ostreatus*
T21= Sesame straw + 3% cotton seed cake + *Pleurotus columbinus*
T22= Raw sesame straw + 3% sunflower seed cake
T23= Sesame straw + 3% sunflower seed cake + *Pleurotus ostreatus*
T24= Sesame straw + 3% sunflower seed cake + *Pleurotus columbinus*

Mycelial growth:

The inoculated containers was covered tightly with plastic sheet and incubated at room temperature. Incubation period was about 4 weeks. At the end of incubation period, the mycelial growth of the tested spawn covered the substrates (Bhandari *et al* 1991). After plastic sheet was removed, the substrates mixed well with mycelia growth and dried into oven 60 °C overnight for chemical analysis.

Data recorded:

The suitability of these treatments for fungal growth was evaluated by:

Chemical analysis: Samples for supplementary materials, raw and spent substrates were dried in oven 60C over night, then ground well. The homogenized samples were analyzed. Crude protein, ash and crude fiber were determined according to A.O.A.C. 1990 whereas fiber fraction were determined according to Van Soest and Breston, (1979). In vitro dry matter digestibility was performed on the raw and treatments materials for 4 weeks according to Menk *et al.* (1979) and the description of Karl and Herbert (1989).

Statistical analysis:

The data were statistically analyzed according to Sendecor and Cochran (1980) using SAS (1998). The difference between means was tested by Duncan's student zed range (HSD) 1955. One way analysis of variance as the mathematical model:

$$Y_{ijk} = \mu + T_i + e_{ijk}$$

Where: Y_{ijk} = Represents observations , μ = Overall means, T_i = Treatments, e_{ijk}=Experimental error.

RESULTS AND DISCUSSION

Proximate analysis:

Before using the supplementary materials, chemical analysis were carried out as presented in Table (1)

Concerning the chemical composition of raw rice straw (T1) and raw sesame straw (T13), treated rice straw (T2 to T12) and treated sesame straw (T14 to T24), data presented in Table (2) and Table (3) showed that, protein content of raw rice straw and raw sesame straw were 2.4% and 1.3% respectively. Incubated supplemented rice straw and sesame straw with *Pleurotus ostreatus* or *Pleurotus columbinus* for 4 weeks increased the protein content for all treatments. Regarding the rice straw, results showed that, the highest increment was recorded for supplemented rice straw with soybean when incubated with *Pleurotus ostreatus* for 4 weeks 237% (T5) followed by supplemented rice straw with soybean incubated with *Pleurotus columbinus* for 4 weeks 229% (T6) can paring with raw rice straw. The results can could be related to the protein content of soybean seed cake (44%). Whereas, increasing protein content in treated sesame straw was observed when sesame straw supplemented with soybean and incubated with *Pleurotus columbinus* for 4 weeks followed by sesame straw supplemented with sunflower and incubated with the same fungi 430% & 330% (T18, T24) respectively.

These results agreed with Lazonal (1990) and Gado *et al* (2006), who reported that, the fruiting bodies remaining after the last harvest were used as a source of protein for feeding dairy cattle and sheep beside that, rice straw treated with fungi increase the crude protein content than other treatments, this could be related to the protein content of oil seed cakes as mentioned in Table (1) . On the other hand, the lowest increasing in crude protein was noticed with rice straw incubated with *Pleurotus columbines,* 15.8% (T3) and sesame straw incubated with *Pleurotus ostreatus &*

Table (1): Chemical composition for the supplementary materials (Sunflower seed cake, Cotton seed cake and Soybean seed cake.)

Oil seed cakes	DM%	CP%	CF%	EE %	ADF %	NDF %	Cell. %	Lignin %	Ash %
Soybean seed cake	87.0	44.0	7.3	1.5	10.0	15.0	7.8	1.5	6.5
Cotton seed cake	91.0	27.1	14.0	1.5	18.0	27.0	13.0	6.0	6.4
Sunflower cake	89.0	26.8	25.0	2.0	30.0	40.0	18.7	7.0	6.2

Table (2): Effect of supplementation with oil seed cakes on the chemical composition of rice straw when incubated with *Pleurotus ostreatus & pleurotus columbinus* (on DM basis)

Treatments	DM%	OM%	CP%	CF%	EE%	NFE	Ash%
T1	92.1	85.8	2.4	39.0	1.0	43.4	14.2
T2	95.3	84.7	6.4	27.6	0.8	49.9	15.3
T3	95.2	84.2	6.2	28.8	1.0	48.2	15.8
T4	91.4	84.7	2.5	39.1	0.6	42.5	15.3
T5	94.9	82.7	8.1	25.4	1.6	47.6	17.3
T6	96.0	81.2	7.9	25.6	0.9	46.8	18.8
T7	89.7	84.2	2.1	39.3	0.4	42.4	15.8
T8	90.5	84.9	7.5	26.1	0.8	50.5	15.1
T9	95.1	84.2	7.4	27.3	1.1	48.4	15.8
T10	93.6	84.6	2.3	39.6	0.5	42.2	15.4
T11	93.4	83.2	7.4	26.5	1.0	48.3	16.8
T12	93.0	83.3	7.5	26.3	1.2	48.3	16.7

T1= Raw rice straw T2= Rice straw treated with *Pleurotus ostreatus*
T3= Rice straw treated with *Pleurotus columbinus*, T4= Raw rice straw + 3% soya bean cake
T5=Rice straw + 3% soya bean seed cake + *Pleurotus ostreatus* T6= Rice straw + 3% soya bean seed cake + *Pleurotus columbinus*
T7= Raw rice straw + 3% cotton seed cake T8= Rice straw + 3% cotton seed cake + *Pleurotus ostreatus*
T9= Rice straw + 3% cotton seed cake + *Pleurotus columbines*, T10= Raw rice straw + 3% sunflower cake
T11=Rice straw + 3% sunflower seed cake + *Pleurotus ostreatus*, T12=Rice straw + #% sunflower seed cake + *Pleurotus columbinus*

Table (3): Effect of supplementation with oil seed cake on the chemical composition of sesame straw when cultivated with *Pleurotus ostreatus & pleurotus columbines* (on DM basis)

Treatments	DM%	OM%	CP%	CF%	EE%	NFE	Ash%
T13	88.4	95.1	1.3	40.2	0.4	53.2	4.9
T14	94.2	94.7	4.1	34.4	1.4	54.8	5.3
T15	95.1	94.2	4.1	33.6	0.5	56.6	5.3
T16	92.9	93.3	1.5	41.5	0.4	50.7	6.7
T17	93.3	92.5	5.2	33.3	1.7	52.6	7.5
T18	93.2	92.8	6.9	33.2	0.8	51.9	7.2
T19	93.5	94.5	1.5	41.5	0.9	50.6	5.5
T20	94.4	94.6	4.8	35.2	1.1	53.3	5.6
T21	95.4	94.3	4.8	34.7	1.0	53.8	5.7
T22	88.6	96.1	1.4	41.0	0.9	52.8	3.9
T23	93.9	94.8	5.4	36.6	0.8	52.0	5.2
T24	92.1	94.8	5.6	36.5	0.8	51.9	5.2

T13= Raw sesame straw T14= Sesame straw treated with *Pleurotus ostreatus*

T15= Sesame straw treated with *Pleurotus columbinus* T16= Raw sesame straw + 3% soya bean seed cake

T17= Sesame straw + 3% soya bean seed cake + *Pleurotus ostreatus*

T18= Sesame straw + 3% soya bean seed cake + *Pleurotus columbinus*

T19= Raw sesame straw + 3% cotton seed cake T20= Sesame straw + 3% cotton seed cake + *Pleurotus ostreatus*

T21= Sesame straw + 3% cotton seed cake + *Pleurotus columbines* T22= Raw sesàme straw + 3% sunflower seed cake

T23= Sesame straw + 3% sunflower seed cake + *Pleurotus ostreatus* T24= Sesame straw + #% sunflower seed cake + *Pleurotus columbinus*

Pleurotus columbines 215% respectively (T14, T15). Data in Tables (2&3) showed that, oil seed cake when supplemented to the rice straw and sesame straw and incubated with *Pleurotus ostreatus or Pleurotus columbinus* for 4 weeks increased the protein content more than rice straw incubated with the same fungus without supplementation.

Concerning crude fiber, data presented in Tables (2 & 3) showed that, crude fiber in raw rice straw and sesame straw were 39.0% and 40.2% respectively. Treated raw rice straw and sesame straw with *Pleurotus ostreatus* and *pleurotus columbinus* for 4 weeks decreased the crude fiber content 29.2, 26.2, 14.4 and 16.4 % (T2, T3, T14 and T15) respectively. Adding oil seeds cakes to rice straw improve the degradation of crude fiber. Results presented in Table (2) showed that, the highest improvement in decreasing CF. was occurred when supplemented the rice straw with soybean seed cake 3% and incubated with *Pleurotus ostreatus* and *Pleurotus columbinus* 34.9%, and 34.4% respectively. Whereas the lowest decreasing in fiber content for supplemented rice straw with oil seeds cakes was observed by supplemented rice straw with cotton seed cake 3% (T9) and incubated 4 weeks with *Pleurotus columbinus* 30%. These results could be due to the degradation enzymes which secret by the fungus as reported by Kuwahara (1993).

Concerning supplemented sesame straw with oil seed cakes and incubation with fungus for 4 weeks. Data presented in Table (3) did not exert detrimental high effect comparing with incubated sesame straw without supplementation, this could be as a result of high content of lignin content in the sesame straw (10%). The highest decreasing in the fiber content was noticed with sesame straw supplemented with soybean seed cake when cultivated with both fungus 17.2% (T17, T18) without differences between the two fungus. On other hand the lowest changes in fiber content recorded with sesame straw (T23, T24) supplemented with 3% sunflower seed cakes (8.95% and 9.2 %), respectively.

Fiber fractions analysis (Lignin, Cellulose and Hemicellulose):

Tables (4&5) presented the effect of treatments on the fiber fractions content, concerning the NDF content, data showed that, the improvement was noticed clearly in supplemented rice straw by soybean when incubated with *Pleurotus columbines* (T6) for 4 weeks 13.8%. Whereas, regarding sesame straw the highest improvement with soybean seed cake and incubated with *Pleurotus ostreatus* (T17) for 4 weeks 10.5%. This improvement due to increase in ligninolytic enzymes such as laccase, this result was in agreement with Garcha *et al*, (1995). Whereas the lowest improvement in NDF was noticed regarding rice straw (T3) incubated with *Pleurotus columbines* 2.96% On other hand concerning sesame straw, the lowest improvement in NDF content was notice when supplemented sesame straw with sunflower seed cake (T24) incubated 4 weeks with *Pleurotus columbines* (2.1%).

Table (4): Effect of supplementation with oil seed cakes on the fiber fractions of rice straw when cultivated with *Pleurotus ostreatus & pleurotus columbinus* (on DM basis)

Treatments	NDF%	ADF%	ADL%	Hemi.	Cellulose%	Lignin%	Ash%
T1	74.1	46.3	12.7	28.9	32.6	5.1	7.57
T2	70.0	42.1	10.2	27.9	31.9	1.2	9.0
T3	71.9	43,0	11.0	28.9	32.0	2.2	8.8
T4	75.21	50.1	10.3	25.1	39.8	4.1	6.2
T5	69.0	47.0	10.6	22.0	36.4	1.6	9.0
T6	63.9	44,5	11.3	19.4	33.2	1.4	9.9
T7	76.6	49.9	15.9	26.7	34.0	7.1	8.8
T8	70.9	48.7	13.1	22.2	35.6	3.7	9.4
T9	70.6	49.0	11.9	21.6	37.1	2.5	9.4
T10	81.0	52.6	13.0	28.3	39.6	6.0	7.0
T11	71.0	40.6	13.8	30.4	26.8	4.0	9.8
T12	69.3	34.0	13.4	35.3	20.6	4.4	9.1

T1= Raw rice straw T2= Rice straw treated with *Pleurotus ostreatus*
T3= Rice straw treated with *Pleurotus columbinus* T4= Raw rice straw + 3% soya bean cake
T5=Rice straw + 3% soya bean seed cake + *Pleurotus ostreatus* T6= Rice straw + 3% soya bean seed cake + *Pleurotus columbinus*
T7= Raw rice straw + 3% cotton seed cake T8= Rice straw + 3% cotton seed cake + *Pleurotus ostreatus*
T9= Rice straw + 3% cotton seed cake + *Pleurotus columbines* T10= Raw rice straw + 3% sunflower cake
T11=Rice straw + 3% sunflower seed cake + *Pleurotus ostreatus* T12=Rice straw + 3% sunflower seed cake + *Pleurotus columbines*

Table (5): Effect of supplementation with oil seed cakes on the fiber fractions of sesame straw when cultivated with *Pleurotus ostreatus & pleurotus columbines* (on DM basis)

Treatments	NDF%	ADF%	ADL%	Hemi.	Cellulose%	Lignin%	Ash%
T13	64.9	50.3	11.0	14.6	39.3	10.2	0.8
T14	59.3	41.5	11.9	17.8	29.6	8.6	3.3
T15	58.2	40.3	10.0	17.9	30.3	8.0	2.0
T16	65.2	51.2	11.5	14.0	39.7	10.5	1.0
T17	58.1	39.2	9.8	18.9	30.4	7.6	2.2
T18	58.5	41.5	9.9	17.0	31.6	7.0	2.9
T19	65.5	49.5	12.3	16.0	37.2	11.4	0.9
T20	59.3	42.3	10.0	17.0	32.3	7.2	2.8
T21	59.2	41.5	10.1	17.7	31.4	7.3	2.8
T22	66.2	52.2	12.5	14.0	39.7	11.3	1.2
T23	62.1	48.3	10.9	13.8	37.6	8.1	2.8
T24	62.9	47.9	10.5	15.0	37.4	7.8	2.7

T13= Raw sesame straw T14= Sesame straw treated with *Pleurotus ostreatus*
T15= Sesame straw treated with *Pleurotus columbinus* T16= Raw sesame straw + 3% soya bean seed cake
T17= Sesame straw + 3% soya bean seed cake + *Pleurotus ostreatus* T18= Sesame straw + 3% soya bean seed cake + *Pleurotus columbinus*
T19= Raw sesame straw + 3% cotton seed cake T20= Sesame straw + 3% cotton seed cake + *Pleurotus ostreatus*
T21= Sesame straw + 3% cotton seed cake + *Pleurotus columbines* T22= Raw sesame straw + 3% sunflower seed cake
T23= Sesame straw + 3% sunflower seed cake + *Pleurotus ostreatus* T24= Sesame straw + 3% sunflower seed cake + *Pleurotus columbinus*

In the same time there is a slight difference in the cellulose and hemicellulose, were observed in case of rice straw and sesame straw at the end of incubation period. Concerning rice straw, data presented in Table (4) showed that, the greatest improvement for cellulose was observed in case of supplemented rice straw with sunflower seed cakes which was treated with *Pleurotus columbinus*, (T12), whereas regarding the hemicellulose, supplemented rice straw with soybean and incubated with *Pleurotus columbinus* (T6) showed good improvement than other treatments. During growth and development of fungi the cellulose decreased from 33.6% to 20.6% and hemicellulose decreased from 27.8% to 19.4% in the supplemented rice straw.

On the other hand, regarding the sesame straw data presented in Table (5) showed that, no high improvement was noticed through all treatments. The highest improvement in cellulose and hemeicellulose was recorded when sesame straw supplemented with cotton seed cakes with *Pleurotus columbinus* and supplemented with sunflower seed cake incubated with *Pleurotus ostreatus* 20.1% and 5.4% (T21, T23) respectively. In this field Eichlerova and Homolka(1997) reported that the white – rot fungi can degrade all the major components of wood and are generally considered to be the main agents of lignin degradation in nature. *Pleurotus spp.* has the ability to secret many enzymes (laccas, cellulase and lignin peroxidase).

Concerning the degradation of lignin content, data presented in Tables (4&5) showed that, the highest degradation for rice straw and sesame straw was observed when rice straw incubated with *Pleurotus ostreatus* and sesame straw supplemented with soybean incubated with *Pleurotus columbinus* 76.4% & 31.4% respectively.

It was clear that, the best improvement in the nutritive value, i.e. increase in crude protein content and decrease in both cellulose and lignin contents, took place after 4 weeks of incubation *Plearotus ostreatus* and *Pleurotus columbinus* on supplemented rice straw and supplemented sesame straw with soybean seed cake

It is clear from Tables (4&5) that the cellulose and lignin contents were used from the two strains and different supplementation were degraded during the incubation period.

In-vitro dry matter (IV-DMD) and In-vitro organic matter (IV-OMD) digestibility:

In -vitro dry matter digestibility (DMD) and *In-vitro* organic matter digestibility (OMD) for rice straw and sesame straw are presented in Tables (6&7). Concerning the rice straw and treated rice straw data presented in Table (6)showed that, the digestibility of untreated rice straw and raw supplemented rice straw with oil seed cakes, were lower than that of the other treatments. High improvement occurred with biological treatment when supplemented rice straw compared with unsupplemented. The same trend was

Table (6). Effect of supplementation with oil seed cakes on IN-VDMD & IN-OMD of rice straw when cultivated with *Pleurotus ostreatus* and *Pleurotus columbinus*

Treatments	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	HSD
INVDMD	33.5c	50.3b	50.4b	33.5c	55.1a	53.2ab	30.9c	54.2ab	52.5ab	30.6.	52.8ab	51.5ab	4.6705
SD ±	0.2872	0.8185	0.6658	1.6502	2.9704	0.8621	0.2081	1.7925	1.7578	0.3527	2.8676	1.3316	---
INVOMD	49.9hg	63.1ab	62.2b	51.3fg	61.5bc	66.2a	48.7hg	58.5dc	55.6de	47.8h	58.0d	53.9fe	3.26
SD ±	0.7637	0.5567	2.1221	1.06926	0.8504	0.4509	0.4509	1.9139	0.4041	0.4509	1.5373	0.9808	---

a, b, c , d, e, f, g, h, Means with different superscripts in the same row differ significantly (P 0.05).

T1= Raw rice straw   T2= Rice straw treated with *Pleurotus ostreatus*
T3= Rice straw treated with *Pleurotus columbinus*   T4= Raw rice straw + 3% soya bean cake
T5=Rice straw + 3% soya bean seed cake + *Pleurotus ostreatus*   T6= Rice straw + 3% soya bean seed cake + *Pleurotus columbinus*
T7= Raw rice straw + 3% cotton seed cake   T8= Rice straw + 3% cotton seed cake + *Ple;urotus ostreatus*
T9= Rice straw + 3% cotton seed cake + *Pleurotus columbines*   T10= Raw rice straw + 3% sunflower cake
T11=Rice straw + 3% sunflower seed cake + *Pleurotus ostreatus*   T12=Rice straw + 3% sunflower seed cake + *Pleurotus columbinus*

Table (7). Effect of supplementation with oil seed cakes on IN-VDMD & IN-OMD of sesame straw when cultivated with *P. ostreatus* and *P. columbinus*

Treatments	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	HSD
INVDMD	41.8d	62.9ab	58.9abc	43.7d	58.7abc	57.8bc	43.2d	58.4abc	54.5c	42.4d	62.1ab	57.8bc	7.0362
SD ±	0.4676	1.9146	1.9451	0.07637	2.2244	3.1056	1.0494	1.2894	4.4478	0.1563	0.8382	3.8480	-- ---
INVOMD	47.9ed	50.2bcde	49.9cde	46.6e	50.7bcd	57.7a	46.9de	54.0ab	52,7bc	48.1de	49.9cde	50.2bcde	3.870
SD ±	0.9753	2.0669	2.1221	1.7910	1.4660	0.7281	0.4095	0.8100	1.5450	0.7695	0.6050	0.9808	----

a, b, c . d, e, f, g, h. Means with different superscripts in the same row differ significantly (P 0.05).
T13= Raw sesame straw T14= Sesame straw treated with *Pleurotus ostreatus*
T15= Sesame straw treated with *Pleurotus columbinus* T16= Raw sesame straw + 3% soya bean seed cake
T17= Sesame straw + 3% soya bean seed cake + *Pleurotus ostreatus* T18= Sesame straw + 3% soya bean seed cake + *Pleurotus columbinus*
T19= Raw sesame straw + 3% cotton seed cake T20= Sesame straw + 3% cotton seed cake + *Pleurotus ostreatus*
T21= Sesame straw + 3% cotton seed cake + *Pleurotus columbines* T22= Raw sesame straw + 3% sunflower seed cake
T23= Sesame straw + 3% sunflower seed cake + *Pleurotus ostreatus* T24= Sesame straw + 3% sunflower seed cake + *Pleurotus columbinus*

obtained concerning raw sesame straw and treated supplemented sesame straw as presented in Table (7). These resulted agreed with Zakia *et al;* (1993) who reported that there is a significant increase in *In -vitro* dry matter enzymatic digestibility in the spent straw supplemented with oil seed cakes over that of the spent straw derived from unsupplemented lot-

Data in Table (6) showed that, the highest increasing in digestibility with incubation *Pleurotus ostreatus* for 4 weeks with rice straw supplemented with soybean (T5) reached to 64 .4% for DMD, no significant differences between this treatment and other treated supplemented rice straw with the fungus (T5, T6, T8, T9, T11 and T12). Where as for the Sesame straw, data in table (7) declared that the highest increasing in DMD was observed with T14,T15,T17,T20 and T23, no significant difference between them when *Pleurotus ostreatus* incubated with sesame straw supplemented with oil seed cakes or without. Kirk and Moore (1972). showed useful correlation's between the extent of lignin removal and in vitro digestibility by rumen micro - organisms .

In a preliminary report Danai *et al*., (1985) noted that there is a significant Linear relationship between lignin content and dry matter digestibility, measured in vitro (IVDMD) with bovine ruminal fluid .

Concerning the organic matter digestibility (OMD) for rice straw, data showed that, the highest increasing in digestibility was noticed with rice straw supplemented with soybean when incubated with *Pleurotus columbinus* (T6) for 4 weeks(32.7%). Data in Table (6 & 7) showed that, the digestibility of treated substrates were higher, ($P< 0.05$) when compared with that of control. On the other hand, concerning the *In-vitro* OMD for sesame straw, the highest increase in IV–OMD (20.5%) was shown with sesame straw supplemented with soybean incubated for 4 weeks with *Pleurotus columbines* T18, followed by T20 and no significant difference between them. Regarding the lowest improvement in OMD data in table (7) showed that, the incubated supplemented sesame straw with sunflower seed cake by both fungus T23, T24 recorded the lowest improvement 3% only.

CONCLUSION

Adding oil seed cakes to the substance during the cultivation of oyster mushroom as a source of natural protein stimulate the fungi growth, increasing the protein content of the substrate and increasing the degradation enzymes.

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تأثير نمو عيش الغراب المحاري على التركيب الكيماوي ومعدلات الإختفاء المعملي لبعض المخلفات الزراعية المدعمة مسبقاً ببعض أكساب البذور الزيتية

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يهدف هذا البحث إلى دراسة تأثير بعض الإضافات الطبيعيه مثل إكساب البذور الزيتية إلى بعض المخلفات الزراعية ودراسة مدى تأثيرها على تحسين التركيب الكيميائى ومشتقات الألياف والقيمة الهضمية المعملية من خلال تنمية فطر عيش الغراب المحارى عليها أصناف *Pleurotus columbinus* و *Pleurotus ostretus*.

تم تجهيز المخلفات الزراعيه (قش الأرز وقش السمسم) بتقطيعها ٣-٦ سم ثم نقعها فى الماء البارد لمدة يوم واحد حتى وصلت نسبة الرطوبه إلى ٦٠ – ٧٠ % ثم إضافة الأكساب بنسبة ٣% (وزن/وزن) كالآتى:-

معاملة الأولى : إضافة كسب بذرة فول الصويا إلى كل من قش الأرز وقش السمسم.

المعاملة الثانية :إضافة كسب بذرة القطن إلى كل من قش الأرز وقش السمسم.

المعامله الثالثة :إضافة كسب بذرة عباد الشمس إلى كل من قش الأرز وقش السمسم

مع إضافة ٣ % (وزن/وزن) من كربونات الكالسيوم إلى كل المعاملات ثم تم نقعها فى الماء المغلى ثم تركت لتصل إلى درجة حرارة الغرفة – ثم صفى الماء تماماً. و تمت الزراعة بوضع خليط المادة العضويه فى صناديق بلاستيكيه على طبقتين سمك الطبقة الأولى ١٥ سم وتنثر فوقها التقاوى المستخدمة فى الزراعة ٥ % (وزن / وزن) ثم تغطية التقاوى. بطبقة أخرى من قش الأرز أو قش السمسم حوالى ٥سمم ثم تغطى الصناديق البلاستيكيه تماما لمدة ٤ أسابيع. و تم أخذ العينات بعد مرور المدة السابقة و تم تحليلها كيميائيا مع اجراء هضم معملى *In- vitro* بإستخدام سائل الكرش. وقد أظهرت النتائج المتحصل عليها:

أولا : <u>التحليل الكيميائى للبيئة المستخدمة فى الزراعة</u> :-

أدت زراعة فطر عيش الغراب المحارى على قش الارز وقش السمسم المضاف إليها كسب فول الصويا بنسبة ٣ % إلى رفع المحتوى البروتينى فى المادة العضوية بنسبة ٢٣٧ % و ٢٢٩ % على التوالى، وأدت أيضا هذه الإضافة على قش الأرز عند تلقيحها بفطرى عيش الغراب المحارى *Pleurotus ostreatur* و *Pleurotus Columbinus* إلى خفض الألياف الخام بنسبة ٣٤,٩ % لكل من الفطرين. أما عند الزراعة على قش السمسم أظهرت الإضافات تحسين بسيط فى إنخفاض نسبة الألياف وكان أكبر إنخفاض عند أضافة كسب فول الصويا عند الزراعة بفطرى عيش الغراب المحارى بنسبة ١٧,٢% *P.ostreatus* , *P.columbines*

أظهرت النتائج إنخفاضا واضحاً فى مشتقات الألياف (لجنين – سيليلوز – هيموسيليوز) بأضافة كسب فول الصويا إلى قش الأرز عند الزراعة بفطرى عيش الغراب.

ثانيا : <u>تجارب الهضم المعملى (*In – Vitro*)</u>

أظهرت النتائج تحسينا كبيرا فى هضم المادة الجافة DMD بإستعمال قش الأرز المضاف إليه كسب فول الصويا والملقح بفطر *P.columbinus* لمدة ٤ أسابيع فى حين لم يتم تحسن واضح فى كل المعاملات الخاصة بإستعمال قش السمسم.