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UTILIZATION OF RECYCLING AGRICULTURAL BY- PRODUCTS IN ANIMAL RATIONS

Mouhamed, E.; [1] Galila A.M.A. Darwish. ; [2] Bakr, .A.A.; [2] Abd – Elhamid, A.A.[3] and Osama, H. M. [2]

1 Faculty of Agric.; Mounofiya Univ,Mounofiya Depart animal production ;

2 Regional Center for Food and Feed, Agricultural Research Center, Giza, Egypt.

3 Institute For Animal Production, Agricultural Research Center, Giza, Egypt.

ABSTRACT

This study was conducted to evaluate the effect of lignocelloses materials (rice straw and banana leaves) on animal nutrition. The tested rations included combination of banana leaves at different rates (5 , 10, 15, 20, 25 and 30 g water hyacinth leaves (WHL) plus 100 gm rice straw or banana leaves). All rations gave good results, but rations included 30 g WHL / 100g rice straw or banana leaves was better than all others. The increase ($P\leq0.05$) in protein content from 2.30 and 12.50 for control to 10.00 and 17.10 % and decrease ($P\leq0.05$) in fiber fraction, (cellulose and lignin), where. cellulose decreased ($P\leq0.05$) from 33.30 and 26.30% to 22.00 and 19.35% and lignin decreased ($P\leq0.05$) from 11.60 and 8.50 to 5.95 and 5.35% in rice straw and banana leaves, respectively. *In vitro* digestibility studies indicated significant ($P< 0.05$) higher values for treatment included 30% WHL with rice straw or banana leaves, respectively.

Pleurotus ostreatus was used to treat by- products of rice straw, banana leaves and WHL by using different amounts of *Pleurotus ostreatus* inoculum, using solid state fermentation technique. All treatments gave good results, but treatment of added 12g *Pleurotus ostreatus* inoculum/100g rice straw or banana leaves was better than other treatments. The protein content increased from (2.30 & 12.50) for control to (7.80 & 16.04%) while there was decrease ($P<0.05$) in hemicellulose and lignin. Hemicelluloses decreased ($P< 0.05$) from (27.50, 16.25) to (19.00, 12.80%) in rice straw and banana leaves, respectively. DMD, OMD digestibility increased form (26.74 and 29.68) for control to (55.55 and 59.10%) for rice straw and from (29.55 and 31.60) for control to (50.20 and 56.20%) for banana leaves, respectively. Cellulose, hemicellulose and lignin showed gradual decrease ($P< 0.05$) with increasing inoculums of *Pleurotus ostreatus*, however, *in vitro* di**s**appearance increased.

Keywords: Rice straw, Banana leaves, Water hyacinth leaves, *Pleurotus ostreatus*, *in vitro* disappearance.

INTRODUCTION

In Egypt, the reduction in local feedstuff recourses consider as the main constrain for improving and developing animal production. Many problems confront the development of livestock, one of which is shortage of feedstuffs and the high cost of concentrate feed mixture. Therefore, it believed that inclusion of some agricultural by-products to replace part of the concentrate diet become an obligation (**EL-Ashry *et al*., 2001; Deraz and Ismail, 2001 and Bassuny *et al*., 2003).**

Egypt, haslack in protein feed ingredient for animal feeding. Some studies were carried out to improve the quality of protein feed ingredient **(EL-Sayed *et al.*, 2002)** or to use new sources of protein **(Mohi El-Din *et al.*, 2008; Leupp *et al.*, 2009; May *et al*., 2009; Shwerab *et al.*, 2012 and Etman *et al*., 2011)** in ruminant rations. Agricultural crop residues are still increase dramatically causing severe pollution problems, with a production of approximate 35 million tons on DM basis per year. Traditionally, they used as fodder, cooking fuel or fencing. Recently, return of residues into the field, such as leaving crop residues on the soil surface, to incorporate into the soil, become popular for enhancing soil quality. **(Ministry of Agric. Egypt, 2007).**

Rice straw represents an important summer crop by-product in Egypt. About 3.5 million tons of rice straw and 0.5 million tons of rice hulls produced every year from rice fields and rice milling process, respectively. Banana wastes can play an important role in covering some nutritional requirements of animals **(Abd-EL-Gawad *et al.*, 1994)** especially because they are available, in Egypt, all over the year **(*Khattab et al.*, 2000).** The native agricultural crop residues are slowly digested by rumen microorganisms and considered a poor fermentable substrate. Thus, physical (milling) and addition of water hyacinth leaves as treatment for these substrates are necessary to disrupt the physical fine structure of cellulose as well as to remove lignin **(Yildz *et al.*, 2002)**.

Water hyacinth plant used to adsorp several cations from waste water. The dried leaves of water hyacinth plant used for adsorbing different metal ions. Several studies investigated the influence of pH, time, metal concentration and absorbent loading weight on the removal process (**Abia *et al*., 2002**; **Singh *et al*., 2005**; **Abd El-Ghani** and **El-Chaghaby**, **2007**).

Many researchers studied chemical and biological pretreatments used for enhancing conversion of lignocellulosic materials to protein enriched product (**Vijaya *et al*., 2007**). *Pleurotus pulmonarius,* via solid-state fermentation technique, act for enhancement of *in vitro* digestibility of protein content on expense of crude fiber and fiber fraction contents **(Leifa *et al.*, 2000 and Zhang *et al.*, 2002)**

The main objective of the current study concerned with upgrading nutritional value of rice straw, banana leaves and WHL into protein enriched by-products via using combined mixture of them with white rot fungi (*Pleurotus ostreatus*) in solid state fermentation process.

MATERIALS AND METHODS

Rice straw and banana leaves were obtained from the experimental farm of Agricultural Research Center, Giza, Egypt. They rinsed with water, air dried, then cut into about 1-2 cm. The chopped rice straw and banana leaves dried at 70 ºC for 24 hour.

White rot fungi, namely *Pleurotus ostreatus* NRRL-2366, was obtained from the National Research Center of Agricultural Utilization Research Service, US., Department of Agricultural, Peoria, Illinois, USA. The strain was maintained on potato dextrose agar medium (**Difco Manual**, **1979)**, then stored at 4ºC.

Microbiological methods

Preparation of grains Spawn:

To prepare grains master spawn, wheat seeds or sorghum seeds were used. Seeds were cleaned from debris, then soaked in water overnight. Dead seeds were removed, then boiled in water for 15 min. After cooling, the seeds transferred to a round bottle by occupying 2/3 of its volume and mixed with calcium carbonate 2% (w/w) and calcium sulphate 1% (w/w). Bottles sterilized for 1hr at 121ºC. After cooling, the sterilized bottles inoculated with mycelia discs (5 mm diameter) which were born from the margins of 6 days old culture of *Pleurotus ostreatus*. The inoculated bottles incubated at 25 ºC for 15-20 days. The grains master spawn used to inoculate bags containing (100 g) pasteurized maize stalks. **(El-Kattan and El –Haddad, 1998)**.

Solid-state cultivation technique*:*

The nutritional upgrading trial of rice straw or banana leaves were carried out in plastic bags contained 100 g of each straw or leaves of 1-2 cm length which pasteurized in hot water 90 ºC for 2 hrs. The moisture content of rice straw or banana leaves adjusted to 70%. The bags inoculated with 10-12g *Pleurotus ostreatus* spawn, in combined mixture with water hyacinth leaves (5, 10, 15, 20, 25 and 30g/ 100 g rice straw or banana leaves) for each bag. The inoculated bags incubated at 28 ºC for 28 days **(Darwish, 2000).**

Preparation of water hyacinth binary mixtures:

Chopped rice straw or banana leaves were used in different combinations with water hyacinth leaves at different rates (5, 10, 15, 20, 25 and 30 g of WHL/100 g rice straw or banana leaves). These combinations made to explore their effect on nutritive value and digestibility.

Chemical analytical methods

Moisture content, ash, crude fiber, crude protein ether extract, neutral and acid detergent fiber were determined according to separate methods described in **AOAC (2012).** Total hydrolysable carbohydrates were determined according to **Montgomery (1961).** Lignocelluloses fractions based on dry matter basis were determined according to the method of **Van Soest** and **Robertson (1980).**

In vitro disappearance

The *in vitro* dry matter disappearance (DMD) and organic matter disappearance (OMD) of samples were determined according to the two stages technique described by **Tilley** and **Terry (1963).** The rumen liquor was collected from festulated sheep fed ration consisted of 70% wheat straw, 15% alfalfa hay and 15% concentrate feed mixture.

Statistical analysis

Statistical analysis for each separate collected data was done according to **Gomez** and **Gomez (1984).** The treatment means compared using the least significant difference test (LSD) at 5% probability level as out lined by **Waller** and **Duncan (1969).**

RESULTES AND DISCUSSION

The chemical composition of tested materials are given in Tables (1 and 2)showing the limiting factors of their utilization by ruminants which are low crude protein, high fiber and low available energy contents.

Data in Tables (1 and 2) show the biological treatments of rice straw and banana leaves by using different amounts of *Pleurotus ostreatus*, in solid-state cultivation techniques. The obtained results revealed a significant increase ($P<0.05$) in crude protein content of all treated samples, compared to control. The highest protein contents, being 7.90 and 16.04%**,** obtained when rice straw and banana leaves fermented for 28 days, with addition of 10 and 12g *Pleurotus ostreatus incoulum,* respectively. Commonly, the protein content increased in all treatments including *Pleurotus ostreatus* compared to treatment of rice straw or banana leaves without *Pleurotus ostreatus*.

The fiber fractions content most significantly decreased in all treatments compared to control. The highest decrease was in lignin (11.60 to 8.10% for rice straw and 8.5 to 5.49% for banana leaves).

The obtained results also showed a decrease in cellulose and hemicelluloses contents compared to control. Gradual decrease in lignin content was noticed during different incubation periods. The extent of lignin degradation could attributed to the ability of *Pleurotus ostreatus* to produce lignin degraded enzyme such as lignin peroxidase and manganese peroxidase which aid the enzymatic degradation (**Nerude** and **Misarcova, 1995)**.

The reviewing of results indicates that rice straw is deficient in protein, energy, and minerals yet has quite low nutritive value. Physical, chemical and microbiological methods have been investigated to improve the digestibility and nutritive value of these by-products. Supplementation with energy, protein, minerals and vitamins resulted in improving the utilization of roughages (**Hamza *et al.*, 2006; Darwish, 2007; Darwish and Bakr, 2010).**

As shown in tables 1 and 2 , results of *in vitro* dry matter disappearance (IVDMD) and *in vitro* organic matter disappearance (IVOMD) revealed their maximum values for rice straw treated with 12 g inoculums of *Pleurotus ostreatus* (55.55 and 59.10% compared to 26.74 and 29.68% for control), while for banana leaves being 50.20 and 56.20%, also with 12 g addition, compared to 29.55 and 31.60% for control). .

These results come in agreement with **Mukherjee** and **Nandi (2004), Vijaya *et al*.,**

(2006) and **Guides *et al.*, (2008),** as they found that lignin decomposed (delignified) by fungus consequently leads to an increase in (IVDMD) which is considered a positive change by increasing the overall digestibility of feed composition. **Zadrazil** and **Kamra (1989**) reported improvement of *in vitro* digestibility after fermentation with *Pleurotus spp.*

In addition, these residues are needed to increase protenuaus compounds. The raw composition of crop residues is unsuitable for animal feeding. Therefore, WHL should take place, by mixing with rice straw or banana leaves at different rates (5, 10, 15, 20, 25 and 30g/100g substrate). It could be clear that WHL contain high amounts of crude protein and minerals. In this study, we made treatments combination of rice straw, banana leaves and WHL to upgrade the nutritive value and *in vitro* digestibility to suitable use as fodder for ruminants. The structural chemical changes in the components of the resulted product were evaluated (Tables 3 and 4).

The obtained results revealed increasing of crude protein in all treatments in comparison with control. A high protein content, 10.00 and 17.10% noticed for the mix 30g water hyacinth leaves with 100 g rice straw or banana leaves, respectively. Commonly, the protein content increased with all treatments. Similar results were reported by **Abd El-Rahman** (**1996**), **El-Shaer *et al*.** (**2005**) and **Abd El-Hamid *et al*.** (**2006**).

The obtained results also revealed that crude fiber decreased with all treatments. Similar resultswere reported by **Rogosic** *et al.*, (**2005**) and **Boghuhn** *et al*., (**2006**).

The obtained results also confirmed a decrease in fiber fractions contents. Cellulose and hemicellulose were decreased with all tested treatments, whereas they decrease from 33.30 and 27.50 to 11.71 and 21.74%, respectively, when mixed 30 g WHL with 100 g rice straw, while being 16.88% and 8.97%, respectively, when mixed 25 g water hyacinth leaves with 100 g banana leaves. It was interest to determine gradual decrease in lignin in course of different ration. Degradation of lignin resulted in increasing *in vitro* digestibility of rice straw, banana leaves and water hyacinth leaves mixture thus confirming their use as feed for ruminant animals. These results are in agreement with the findings of **Blummel** and **Becker** (**1997**); **Allam** *et al.*, (**2006**) and **Patra** (**2007**).

In vitro dry organic matter disappearance (IVOMD) showed significant ($P<0.05$) increase. In general, the obtained results cleared that treatment succeeded to improve the nutritive value of rice straw, banana leaves and water hyacinth leaves mixture to allow use for ruminant feeding. These results agree with **Khattab *et al*,. (1999); Patra *et al.*, (2006); Darwish and Ali (2005); Agarwal *et al*., (2006); Chumpawadee *et al*., (2007); Sallam *et al.*, (2007) and Darwish and Bakr (2010)-**

CONCLUSION

This study indicated that treatments of rice straw or banana leaves as agricultural by-products with combination of WHL and *Pleurotus ostreatus* can increase crude protein and improve in vitro dry matter digestibility (IVDMD) and in vitro organic matter digestibility (IVOMD). Furthermore, this study opened useful application access for production of rice straw or banana leaves based products of good quality. Moreover, the current study can add applied values based on fungal treatment of non beneficial agricultural by-products.

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Table (1): Biological treatment of rice straw using different amounts of **Pleurotus ostreatus* inoculum in solid state fermentation technique (incubated at 28º C for 4- weeks).

Fungal spawn amounts (g)	Biomass recovery (g)	Crude protein		Net gained protein (g)	Fungal mycelial dry wt. (g/100g)	Undergirded substrate (g)	Degraded substrate (g)	Bioconversion efficiency %	In vitro disappearance		Chemical analysis of biomass recovery			
		%	(g)						DMD	OMD	Hemi-cellulose %	Cellulose %	Lignin %	Ash %
2 g	74.24	2.80	2.10	0.50	1.43	72.81	27.19	1.84	40.20^{bc}	41.80^{bc}	28.10^{b}	35.10^{a}	9.90^{b}	16.80^{c}
4 g	75.30	4.70	3.54	2.40	6.86	68.44	31.56	7.61	42.60^{bc}	45.50^{bc}	22.90^{bc}	35.20^{a}	9.30^{bc}	17.10^{bc}
6 g	76.24	4.90	3.74	2.60	7.43	68.81	31.19	8.34	46.10^{bc}	48.20^{bc}	23.30^{bc}	33.80^{bc}	9.10^{bc}	17.30^{b}
8 g	78.20	6.30	4.93	4.00	11.43	66.77	33.23	12.04	46.30^{bc}	48.20^{bc}	22.70^{bc}	33.00^{c}	8.10^{c}	17.50^{b}
10 g	76.00	7.90	6.00	5.60	16.00	60.00	40.00	14.00	50.20^{abc}	56.60^{ab}	20.20^{c}	34.30^{bc}	8.30^{c}	18.00^{a}
12 g	77.02	7.80	6.01	5.50	15.71	61.31	38.69	14.22	55.55^{a}	59.10^{a}	19.00^{c}	34.00^{b}	8.85^{b}	18.10^{a}
Control	100.00	2.30	2.30	_	_	100.00	_	_	26.74^{c}	29.68^{c}	27.50^{a}	33.30^{c}	11.60^{a}	16.70^{c}

a, b, c ……… Means in the same column with different superscripts significantly different ($p<0.05$)
Net gained protein = crude protein obtained - initial protein of substrate .
Fungal mycelial dry wt = (Net gained protein × 100/ Fungal protein)
Undegraded substrate = biomass recovery – mycelia dry wt.
Degraded substrate = 100 - undegraded substrate.
Bioconversion efficiency % = (Net gained protein × 100/ Degraded substrate).
Crude protein content of *Pleurotus ostreatus* (35%).

Table (2): Biological treatment of banana leaves using different amounts of **Pleurotus ostreatus* inoculums in solid state fermentation technique (incubated at 28º C for 4- weeks.

Fungal spawn amounts (g)	Biomass recovery (g)	Crude protein		Net gained protein (g)	Fungal mycelial dry wt. (g/100g)	Undergirded substrate (g)	Degraded substrate (g)	Bioconversion efficiency %	In vitro disappearance		Chemical analysis of biomass recovery			
		%	(g)						DMD	OMD	Hemi-cellulose %	Cellulose %	Lignin %	Ash %
2 g	78.78	14.00	11.03	0.40	1.14	77.64	22.36	1.80	47.80^{bc}	54.20^{bc}	19.87^{a}	28.70^{a}	8.34^{a}	12.00^{c}
4 g	79.35	14.44	11.46	0.84	2.40	76.95	23.05	3.64	48.70^{bc}	55.30^{bc}	19.45^{a}	27.75^{a}	8.00^{b}	12.25^{bc}
6 g	79.10	14.78	11.70	1.18	3.37	75.73	24.27	4.86	49.00^{bc}	55.20^{bc}	17.42^{bc}	25.84^{b}	7.17^{bc}	12.60^{b}
8 g	80.00	15.01	12.01	1.41	4.03	75.97	24.03	5.87	49.50^{a}	55.70^{bc}	14.13^{bc}	24.44^{c}	6.3 0^{bc}	12.88^{b}
10 g	79.23	15.17	12.11	1.57	4.49	74.74	25.26	6.22	49.20^{bc}	56.10^{a}	13.10^{c}	23.86^{c}	5.63^{c}	12.95^{a}
12 g	80.04	16.04	12.84	2.44	6.97	73.07	26.93	9.10	50.20^{a}	56.20^{a}	12.80^{c}	27.67^{a}	5.49^{c}	13.05^{a}
Control	100.00	12.50	12.50	_	_	100.00	_	_	29.55^{c}	31.60^{c}	16.25^{a}	26.30^{bc}	8.50	11.96^{c}

a, b, c ……… Means in the same column with different superscripts significantly different ($p<0.05$)
Net gained protein = crude protein obtained - initial protein of substrate .
Fungal mycelial dry wt = (Net gained protein × 100/ Fungal protein)
Undegraded substrate = biomass recovery – mycelia dry wt.
Degraded substrate = 100 - undegraded substrate.
Bioconversion efficiency % = (Net gained protein × 100/ Degraded substrate).
Crude protein content of *Pleurotus ostreatus* (35%).

Table (3): Biological treatment of rice straw and water hyacinth leaves mixture by using *Pleurotus ostreatus* in solid state fermentation (incubated at 28 º C for 4- Weeks)

Fermented media mixture ratio	Dry Matter %	Total hydrolysable carbohydrates %	Ether Extract %	Crude protein%	Crude Fiber%	In vitro disappearance		Chemical analysis of biomass recovery			
						DMD	OMD	Hemi-cellulose %	Cellulose%	Lignin%	Ash %
*Rice straw(RS) (control)untreated	86.60	34.10	1.20	2.30	39.40	26.74^{c}	29.68^{c}	27.50^{a}	33.30^{a}	11.60^{b}	16.70 ^{NS}
**Water hyacinth leaves(Wh)untreated	85.87	32.50	3.05	20.90	20.80	40.44^{bc}	52.81^{b}	13.64^{bc}	15.15 ^{c}	5.73^{c}	17.99 ^{NS}
RS+W h (5g) untreated	85.80	25.25	1.30	3.23	38.47	42.50^{bc}	46.70^{bc}	18.30^{b}	35.35^{a}	13.00^{a}	17.55 ^{NS}
RS+W h (5g) treated	78.50	20.01	1.54	7.40	33.86	44.30^{ab}	53.20^{b}	19.32^{b}	34.72^{a}	12.27^{b}	17.60 ^{NS}
RS+W h (10g) untreated	83.90	22.95	1.40	5.70	37.54	42.80^{bc}	48.80^{ab}	20.29^{b}	33.72^{a}	11.90^{b}	17.00 ^{NS}
RS+W h (10g) treated	77.16	20.72	1.47	7.50	33.12	46.30^{ab}	54.80^{b}	16.47	34.89^{a}	9.99^{ab}	16.35 ^{NS}
RS+W h (15g) untreated	83.50	23.88	1.59	6.30	36.61	42.80^{bc}	46.80^{bc}	17.24^{ab}	31.52^{ab}	7.51^{bc}	16.02 ^{NS}
RS+W h (15g) treated	75.51	20.00	1.63	7.60	33.07	46.50^{ab}	54.70^{b}	14.18^{bc}	28.39^{bc}	7.05^{bc}	16.23 ^{NS}
RS+W h (20g) untreated	82.48	23.80	1.56	6.50	35.68	42.90^{bc}	47.80^{bc}	14.11^{bc}	25.72^{bc}	6.33^{c}	15.95 ^{NS}
RS+W h (20g) treated	72.00	16.59	1.64	7.90	31.88	47.40^{ab}	55.10^{a}	13.56^{bc}	23.19^{bc}	5.58^{c}	15.99 ^{NS}
RS+W h (25g) untreated	81.73	23.70	1.67	6.83	34.75	43.50^{bc}	48.10^{ab}	14.02^{bc}	21.88^{bc}	5.83^{c}	16.11 ^{NS}
RS+W h (25g) treated	71.20	18.23	1.94	8.00	28.48	48.50^{a}	55.10^{a}	14.26^{bc}	21.39^{bc}	5.55^{c}	16.20 ^{NS}
RS+W h (30g) untreated	81.80	23.00	1.53	8.20	33.82	43.60^{bc}	48.60a^{b}	14.11^{bc}	22.00^{bc}	6.10^{c}	16.43 ^{NS}
RS+W h (30g) treated	70.00	17.21	1.69	10.00	25.37	49.50^{a}	55.70^{a}	11.71^{c}	21.74^{bc}	5.59^{c}	16.73 ^{NS}

a, b, c ……… Means in the same column with different superscripts significantly different ($p<0.05$)

Table (4) : Biological treatment of banana leaves and water hyacinth leaves mixture by using ****Pleurotus ostreatus* **in solid state fermentation (incubated at 28 º C for 4- Weeks)**

Fermented media mixture ratio	Dry matter %	THC %	EE %	CP %	CF %	In vitro disappearance		Chemical analysis of biomass recovery			
						DMD	OMD	Hemi-cell. %	Cell. %	Lignin %	Ash %
*Bl untreated	88.40	38. 55	1.75	12.50	28.50	29.55^{c}	31.60^{c}	16.25^{a}	26.30^{a}	8.50^{b}	11.96^{c}
**Wh untreated	85.87	32.50	3.05	20.90	20.80	40.44^{bc}	52.81^{bc}	13.64	15.15^{c}	5.73^{c}	17.99^{a}
Bl+W h (5g) untreated	85.98	30.55	2.02	12.93	28.22	49.10^{ab}	54.60^{bc}	15.68^{a}	24.46^{b}	9.60^{a}	12.26^{bc}
Bl+W h (5g) treated	78.20	23.99	2.20	14.10	25.49	52.60^{ab}	58.20^{b}	14.38^{b}	22.96^{b}	9.10^{a}	13.42^{ab}
Bl+W h (10g) untreated	86.59	29.50	2.32	13.34	27.90	49.50^{ab}	55.70^{ab}	15.54^{a}	23.47^{b}	9.46^{a}	13.60^{ab}
Bl+W h (10g) treated	77.14	21.00	2,58	15.40	24.44	54.60^{b}	59.60^{a}	14.52^{b}	22.65^{b}	8.99^{b}	13.95^{b}
Bl+W h (15%) untreated	81.04	23.10	2.40	13.77	27.60	55.60^{b}	59.80^{a}	14.02^{b}	22.57^{b}	8.18^{ab}	14.20^{b}
Bl+W h (15g) treated	76.00	19.05	2.95	15.80	23.81	56.20^{b}	60.20^{a}	12.41^{bc}	20.10^{ab}	7.39^{ab}	14.47^{b}
Bl+W h (20g) untreated	84.83	25.90	2.73	14.18	27.30	53.80^{b}	59.60^{a}	11.80^{bc}	21.00^{ab}	7.37^{ab}	14.70^{b}
Bl+W h (20g) treated	75.50	18.00	3.30	16.70	22.92	54.20^{b}	60.10^{a}	11.25^{bc}	19.35^{ab}	6.30^{c}	15.30^{a}
Bl+W h (25g) untreated	81.43	22.22	2.77	14.60	27.00	54.20^{b}	60.60^{a}	10.90^{bc}	19.00^{b}	6.00^{c}	14.95^{b}
Bl+W h (25g) treated	73.85	16.10	3.45	17.00	21.90	60.60^{a}	54.20^{bc}	10.55^{bc}	17.85^{c}	5.85^{c}	15.90^{a}
Bl+W h (30g) untreated	79.51	19.65	2.98	15.02	26.60	54.70^{b}	56.77^{bc}	10.34^{bc}	17.15^{c}	5.75^{c}	15.29^{a}
Bl+W h (30g) treated	71.24	14.44	3.84.	17.10	19.78	61.90^{a}	54.60^{bc}	8.97^{c}	16.88^{c}	5.35^{c}	16.10^{a}

a, b, c ……… Means in the same column with different superscripts significantly different ($p<0.05$).

الإستفادة من تدوير المخلفات الزراعية فى علائق الحيوان

محمد أحمد الحويطي[1]- جليله علي محمد علي درويش [2] – عادل أحمد بكر [2] – أسامه حسن محمد السيد [2] - أيمن عبد الحميد (3)

1- **قسم الإنتاج الحيواني- كليه الزراعة – جامعة المنوفيه**
2- **المركز الإقليمي للأغذية و الأعلاف – مركز البحوث الزراعية- الجيزه**
3- **معهد بحوث الإنتاج الحيواني- مركز البحوث الزراعية- الجيزه**

اجريت هذه الدراسة لتقييم تأثير المواد اللجنوسليلوزية (قش الأرز – أوراق الموز) على تغذية الحيوان . استخدم فى هذه الدراسة مخلوط من أوراق ورد النيل مع قش الأرز أو أوراق الموز بنسب (5 ، 10 ، 15 ، 20 ، 25 ، 30 جم) لكل 100 جم من قش الأرز أو أوراق الموز على التوالى . المخلفات اللجنوسليلوزية المستخدمه بدون أى معاملات كيماوية أو بيلوجية (الكنترول) مقارنتا بالإضافات من أوراق ورد النيل بنسب مختلفه (5- 10 – 15 – 20- 25 و30) لكل 100 جرام من قش الأرز أو أوراق الموز . حيث زاد البروتين من 2.30 و12.50 (كنترول) إلى 10.0 و17.10%، ونقص فى نسبه السيليلوز والهيموسيليلوز واللجنين . حيث نقص السيليلوز من 33.30 و 26.30 إلى 22.0 و 19.35 % وكذلك اللجنين من 11.60 و8.50 الى 5.95 و5.35 % فى كل من قش الأرز وأوراق الموز بعد إضافه 30 جرام من أوراق ورد النيل على التوالى . كذلك النسبه الهضميه كانت أعلى معدلاتها فى معامله إضافه 30 جرام من ورد النيل إلى كل من قش الأرز وأوراق الموز على التوالى لإنتاج علف حيوانى غير تقليدى . كذلك إستخدام فطر عيش الغراب المحارى *Pleurotus ostreatus* أدى الى رفع القيمة الغذائية للمخلفات المستخدمه لكل من التركيب. الكيماوى لها والنسبه الهضميه.