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EFFECT OF CHEMICAL AND BIOLOGICAL TREATMENTS OF SOME CROP RESIDUES ON THEIR NUTRATIVE VALUE. 2- EFFECT OF BIOLOGICAL TREATMENTS ON CHEMICAL COMPOSITION AND *IN-VITRO* DISAPPEARANCE.

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SUMMARY

Six crop residues namely wheat straw, rice straw, cotton stalks, corn stalks and pinnae and mid ripe of date palm were subjected to biological treatments using solids state fermentation technique (SSF) to upgrade its nutritive value to be serve as a part of rummenant ration. The residues were moistend at solid : liquid ration 1 : 2 with solution composed of 4% molasses, 0.4% urea, 0.2% $K_2H\ PO_4$ and 0.03% $MgSO_4.7H_2O$. The moistened residues were inoculated with 10% (v / w) inoculum of *Trichoderma viride*, or *Saccharomyces cerevisiae* and 5% (v / w) of both when coculture was applied. The inoculated residues were incubated at room temperature (30°C ± 2) for 21 days.

The highest increase in crude protein contents for wheat straw, rice straw, cotton stalks and pinnae and midrib of date palme tree was achieved by coculture of *T. viride* and *S. cerevisiae* treatment. On the other hand, treatment with fungal culture alone was more suitable for corn stalks residues. The highest losses in dry matter (DM) as a result to coculture treatments was seen for corn stalks, since it was 11.0% followed by rice straw and wheat straw as it were 9.0 and 8.0% respectively. The lowest losses in dry matter were shown for pannae and mid rib of plam tree as it were 4.37 and 2.55, respectively. Biological treatments significantly decreased neutral detergent fiber (NDF) and acid detergent fiber (ADF) specially for treatments by fungus or fungus followed by yeast. Nutritive values were enhanced for all treated residues as *IVOMD* wheat straw, rice straw, cotton stalks, corn stalks, and pinnae and mid rib of date palme tree of were raised from 64.39, 62.45, 73.04, 78.10, 72.65 and 72.35 to be 81.21, 72.4, 80.87, 82.51, 78.89 and 76.02 respectively.

Keywords: *Trichoderma viride, Saccharomyces cerevisiae, rise straw, wheat straw.*

INTRODUCTION

The shortage of feeds in general and protein in particular attracted the attention of many research workers towards the unconventional sources of feeds crop residues are mainly fibrous materials that are by-products of crops cultivation which from a high percentage of the total volume of the feeds produced annually in Egypt. However, only 4.0 to 4.3 million tons of crop residues out of 13.7-15.2 million tons produced are used for feeding ruminants (Hathout and El-Nouby, 1990).

residues are burned or wasted, and hence lead to environmental pollution and consequently health hazards. The primary factors limiting the utilization of crop residues are of low digestibility, low protein content and of low palatability. Thus, to increase digestibility of crop residues, it is important to destroy the linkage between cellulose, hemicellulose and lignin or to destroy the compact nature of the tissue, so that liginfied tissue is separated from non-lignified one. There have been attempts to do that by mechanical, chemical or biological treatments (Bakr *et al.*, 1975 and Jakson, 1978).

In the recent years much interest has been evinced in new biotechniques for improving the nutritive value of lignocellulosics using biological treatments in a solid substrate fermentation (SSF) system under non sterile conditions (Han, and Andreson 1975). Although, the SSF is slower than the liquid or submerged fermentation system, due to an additional barrier from the bulk solids, the farmer has the advantage of substantially reducing the space occupied by the fermentor without seriously affecting the yield of biomass (Moo-Young *et al.*, 1983).

The objectives of this study were to investigate. The ability of fungal yeast treatment to improve nutritive values of some crop residues.

MATERIALS AND METHODS

Microorganisms

Trichoderma viride F-516 and *Saccharomyces cerevisiae* AFZ-98 were obtained from Microbial Chemistry Department, National Research Centre, Dokki, Egypt. The microorganisms were mentioned on agar medium composed of (g / L) malt extract, 30.0; mycolo gical peptone, 5.0 and agar 20.0.

Crop residues

Rice straw, wheat straw, cotton stalks and corn stalks were obtained from waste department, Animal Production Institute Agriculture Research Center, Agriculture Ministry, Pinnae and mid rib of date palm tree were collected from date palm tree located in Faculty of Agricultural, Ain Shams Univ., Shoubra El-Kheima.
Chemical Composition of collected crop residues was carried out according to A.O.A.C. methods (1990) and results are shown in Table (1).

Table 1. Chemical composition of crop residues used in the work.

Crop residue	DM	OM	CP	Ash	Cellulose	Hemicellulose	Lignin	CF*	EE**	NFE***
Wheat straw	92.1	80.69	5.81	16.31	39.51	24.17	11.16	33.03	0.46	41.39
Rice straw	92.68	84.38	4.41	15.62	43.30	22.40	12.29	33.61	0.41	45.95
Cotton stalks	91.86	93.46	4.74	6.54	42.2	30.16	14.3	50.68	0.71	37.33
Corn stalks	91.43	80.92	4.74	19.08	30.51	36.42	10.5	30.67	0.69	44.77
Pannae of date palm	92.81	89.83	9.01	10.17	40.10	22.23	15.30	31.25	1.89	47.68
Mid rib of date palm	92.07	93.98	5.43	6.02	43.92	26.21	18.93	40.45	0.14	47.96

DM = dry matter OM = organic matter CP = crude protein
* Crude fiber ** Ether extract *** Nitrogen free extract

Preparation of crop residues for biological treatments

The air dried residues were chopped to about 3-5 cm, then packed till use.

Preparation of fungal inoculum

Three days old slant (20 x 200 mm) of *Trichoderma viride* F-516 was chrused into a flask containing 25 ml of sterilized water. The inoculum was used to inoculate 500 ml-capacity conical flasks containing 20 g of cooled sterilized residue

by (autoclaving for 121°C for 30 minute-moistened by basal medium containing g / L 4% molasses, 0.4% urea, 0.2% KH_2PO_4 and 0.03 $MgSO_4.7H_2O$ in solid liquid ratio 1:2 by 10% (v / w).

The inoculated flasks were incubated in adjusted temperature incubator at 30°C±2 for 5 days.

Propagation of fungal biological treatment

The above prepared inocula were employed to inoculate polyethylene bags containing 200g of the demand residues moistened at solid : liquid ratio 1 : 2 by the above basal medium. The inoculated bages were incubated at 30°C±2 by solid state fermentation system (SSF) for 21 days. At the end of the biological treatment period the bages were opened, oven dried at 70°C and milled. The chemical analysis was performed.

Preparation of yeast inoculum

Forty eight hour old slants of *S. cerevisiae* AFZ-98 was used to inoculate 500 ml capacity conical flasks containing sterilized 100 ml of the above basal medium. The flasks were incubated at 30°C in shaker incubator for 48 h.

Propagation of biological treatment with yeast

The above prepared yeast inoculum was employed to inoculate polyethylene bags containing 200 g of the demand crop residue moistened by the basal medium in solid : liquid ratio 1 : 2 at 10% (v/w). The inoculated bages were incubated for 21 days at 30°C. At the end of incubation time the same was done as in fungal treatment for chemical analysis.

Coculture treatment

The polyethylene bag containing 200 g of crop residues were inoculated with 10% (w/w) fungal culture inoculum, and after 5 days inoculated with 5% (v/w) yeast culture and continued to ferment till 21 days at 30°C.

The biological treated residues were oven dried at 70°C to constant weight, then miled through an approximate 1 mm sieve.

Enzymes assays

Five grams of each biologically treated residues in the end of fermentation period was suspended in 50 ml 0.05 M citrate buffer pH 5.0 shaked for one hour at 150 rpm. The samples were filtered through glass wool, then centrifuged under cooling. The clear supernatants were used to determine cellulase (CMCase) according to the method described by Mandels *et al.* (1976) and hemicellulase (Xylanase) according to the method of Bailey *et al.* (1992). The enzymes units was calculated on the basis of dry weight. The enzyme unit (IU) is defined as the micro mol of basal substrate unite produced in one minute under reaction conditions

Analysis of biological treated residues

Proximate chemical analysis of raw and treated crop residues were analyzed for dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF) and ash content according to the A.O.A.C (1990). The nitrogen free extract (NFE) was calculated by subtracting the summation percentages of CP, EE, CF and Ash content from one hundred.

Fiber fraction determinations

Dried samples were analyzed according to Goering and Van Soest (1970) to determine neutral detergent fiber (NDF), acid detergent fiber (ADF), hemicellulose and cellulose were determine by difference.

In vitro disappearance

The in vitro DM (*IVDM*) and in vitro OM (*IVOM*) disappearance were done on

samples according to Tilley and Terry (1963).

Statistical analysis

The data were analyzed according to statistical analysis system user's guide (SAS) (1998). Separation among means was carried out by using Duncan multiple test (1955).

Data of chemical composition were analyzed according to factorial design (three way classification).

RESULTS

Data obtained from biological treatments of six crop residues namely wheat straw, rice straw, cotton stalks, corn stalks, pannae and mid rib of date palm tree are presented in Tables (2-7). Generally, all treatments affect chemical composition of tested residues consequently the *IVDMD* and *IVOMD*. The differentiations of the effect of biological treatment were differ according to type of treatment and type of residue.

Promising results were achieved when coculture of *T. viride* F-516 and *S. cerevisiae* AFZ-98 was applied for wheat straw, rice straw, cotton stalks and pannae and mid rib date palm tree than other biological treatments. On the other hand treatment of corn stalks by *T. viride* F-516 had advantages. The crude protein increased significantly ($P<0.01$) and the highest increasing achieved with coculture of fungus and yeast were with wheat straw and rice straw as it were from 5.81 and 5.6 in control to be 12.95% and 13.2% respectively (Table 2, 3). Meanwhile, the crude protein was raised from 4.74 to 10.11% in cotton stalks (Table 4) and from 4.74 to 10.94 in corn stalks (Table 5). The increase in crude protein was achieved by biological treatment of pinnae of date palm tree with coculture of fungus and yeast was about 4.2% than untreated. Slight increase in crude protein resulted when mid rib of date palm tree was the substrate for fungus and yeast as about 2.4% was achieved.

Dry matter decreased significantly ($P<0.01$) by fungal and coculture of fungal and yeast. The coculture treatments resulted in high losses in dry matter and the losses were differ according to the type of residues. The decreases were 8.0, 9.7, 7.9, 7.7, 4.4 and 3.9% for wheat straw rice straw, cotton stalks, corn stalks, pannae and mid rip of date palm tree respectively (Tables 2-7). No significantly changes ($P<0.05$) in dry matter when the residues were treated with yeast culture alone.

All biological treatments were varied on its effect on organic matter. No significant differences ($P>0.05$) in organic matter of wheat straw when treated with fungal and coculture of fungal and yeast. On the other hand, organic matter was significantly ($P<0.05$) higher than that of control when the residues was treated with yeast culture under culture conditions. Significant ($P<0.01$) decrease in organic matter was obtained with treatments with fungal culture or coculture of fungus and yeast. The most decreases were obtained with fungal treatments for cotton and corn stalks as it were 6.0 and 5.5, respectively.

Hemicellulose, cellulose and crude fiber were significantly decreased ($P<0.01$) by fungal culture and coculture of fungus and yeast. Decreases were in a descending order for wheat straw, rice straw and corn stalks respectively. On the other hand, hemicellulase (Xylanase) and cellulase (CMCase) activities was obtained in a descending order accordance with the decreases in cellulose and hemicellulose for the above residues, respectively.

Ash contents of the fermented residues (Tables 2 to 7) were increased significantly ($P<0.01$) when the residues were treated by fungus or coculture of fungus

and yeast and it were no significant ($P<0.05$) when the treatment were accomplished by yeast.

Tables (2 - 7) showed that the biological treatments significantly ($P<0.05$) decreased NDF and ADF specially for treatment by fungus or fungus followed by yeast. The decreases in NDF and ADF were different between residues.

Data recorded in Tables (2 - 7) showed significantly ($P<0.01$) improvement for *IDVDMD* and *IVOMD*. The improvement rate was higher when wheat straw rice straw and cotton stalks were treated with coculture of fungus and yeast as it were 13.2 and 20.2% for wheat straw, 14.9 and 10% for rice straw and 29.1 and 7.4% cotton stalks, respectively. Fungal treatment of corn stalks improved the *IVOMD* and *IVDMD* than other two biological treatments and it were 14.6 and 4.4%, respectively. Moreover, the treatments of pinnae and mid rip of date palm tree with coculture of fungus and yeast resulted in significant ($P<0.05$) increased for *IVDMD* and *IVOMD* than other treatments and improvement were 14.2 and 6.2% for pannae and 22.3 and 4.2% for mid rip respectively.

Table 2. Effect of biological treatments by *Trichoderma viride* F-516, *Saccharomyces cerevisiae* AF-98 and coculture for 21 days on the chemical composition, *IVDMD* and *IVOMD* of wheat straw.

Item	Biological treatment				±SE
	Control	*T. viride* (1)	*S. cerevisiae* (2)	Coculture (1+2)	
Dry matter (DM)	92.10	84.91	92.60	84.10	0.57
Organic matter (OM)	80.69	74.80	80.81	73.20	0.87
Ash	16.31	17.81	16.41	17.92	0.87
Crude protein (CP)	5.81	10.75	6.90	12.95	0.10
Crude fiber (CF)	33.03	31.01	32.91	30.22	0.21
Ether extract (EE)	0.46	0.66	0.54	0.74	0.07
Nitrogen free extracted (NFF)	41.39	37.16	41.22	36.06	0.96
Fiber fraction					
NDF	68.64	63.02	68.12	62.13	0.56
ADF	48.85	44.14	48.15	43.64	0.31
Hemicellulose	24.17	17.30	24.05	16.81	0.53
Cellulose	33.51	31.16	31.31	28.02	0.53
Lignin	11.16	10.91	11.01	11.81	0.12
Enzymes (IU / g)					
CMCase	---	8.20	--	9.10	0.45
Xylanase	--	12.8	--	16.2	1.98
In vitro disappearance					
IVDMD	47.59	57.63	56.35	60.70	1.46
IVOMD	64.39	69.82	71.97	84.61	1.18

Table 3. Effect of biological treatments by *T. viride* F-516, *S. cerevisiae* AFZ-98 and coculture for 21 days on the chemical composition, *IVDMD* and *IVOMD* of rice straw.

Item	Biological treatment				±SE
	Control	*T. viride* (1)	*S. cerevisiae* (2)	Coculture (1+2)	
Dry matter (DM)	92.10	84.31	92.12	83.10	0.60
Organic matter (OM)	84.38	79.21	84.42	77.60	1.11
Ash	15.62	17.71	15.92	18.11	1.11
Crude protein (CP)	4.41	9.89	4.85	11.23	0.16
Crude fiber (CF)	33.61	30.51	33.41	30.02	0.66
Ether extract (EE)	0.41				0.07
Nitrogen free extracted (NFF)	45.95	42.69	45.77	41.36	0.10
NDF	66.64	59.95	66.16	59.14	2.33
ADF	48.96	45.20	48.21	44.61	1.47
Hemicellulose	21.4	16.1	21.21	15.22	1.08
Cellulose	40.30	30.50	39.40	27.95	1.30
Lignin	12.29	11.92	12.29	13.11	0.08
Enzymes (IU / g)					
CMCase	---	7.18	--	8.25	0.56
Xylanase	--	11.2	--	14.3	1.42
In vitro disappearance					
IVDMD	42.52	54.03	49.96	56.42	1.36
IVOMD	62.45	65.67	78.08	72.43	4.88

Table 4. Effect of biological treatments by *T. viride* F-516, *S. cerevisiae* AFZ-98 and coculture for 21 days on the chemical composition, *IVDMD* and *IVOMD* of cotton stalks.

Item	Biological treatment				±SE
	Control	*T. viride* (1)	*S. cerevisiae* (2)	Coculture (1+2)	
Dry matter (DM)	91.86	85.56	91.91	84.01	0.56
Organic matter (OM)	93.46	96.95	93.51	87.48	0.24
Ash	6.56	6.91	6.71	7.12	0.24
Crude protein (CP)	4.74	9.05	5.20	10.11	0.21
Crude fiber (CF)	50.68	47.58	50.71	47.12	0.23
Ether extract (EE)	0.71				0.07
Nitrogen free extracted (NFF)	37.33	34.23	37.52	33.16	0.50
NDF	67.16	60.77	71.33	60.67	1.05
ADF	53.91	48.68	56.84	78.12	0.63
Hemicellulose	28.16	24.66	28.05	23.14	
Cellulose	35.21	30.12	35.11	24.21	
Lignin	14.32	14.01	14.32	13.85	
Enzymes (IU / g)					
CMCase	---	6.3	--	6.8	0.25
Xylanase	--	10.6	--	11.6	0.50
In vitro disappearance					
IVDMD	40.43	41.76	47.33	69.16	3.25
IVOMD	73.46	77.30	77.40	80.87	2.42

Table 5. Effect of biological treatments by *T. viride* F-516, *S. cerevisiae* AFZ-98 and coculture for 21 days on the chemical composition, *IVDMD* and *IVOMD* of corn stalks.

Item	Biological treatment				±SE
	Control	*T. viride* (1)	*S. cerevisiae* (2)	Coculture (1+2)	
Dry matter (DM)	91.13	81.35	91.45	83.42	0.59
Organic matter (OM)	80.92	74.60	81.06	75.40	0.61
Ash	19.08	21.06	19.21	21.86	0.61
Crude protein (CP)	4.74	12.36	5.16	10.94	0.40
Crude fiber (CF)	30.67	27.42	30.72	27.86	0.30
Ether extract (EE)	0.69	0.89	1.16	0.79	0.01
Nitrogen free extracted (NFF)	44.77	40.57	44.82	39.05	0.77
					1.12
NDF	63.96	54.05	62.36	61.42	0.81
ADF	42.12	41.75	44.11	37.98	0.69
Hemicellulose	32.42	20.31	32.42	21.28	0.54
Cellulose	26.51	21.16	26.41	22.05	
Lignin	10.55	10.11	10.55	11.82	
Enzymes (IU / g)					
CMCase	---	8.42	--	9.62	0.60
Xylanase	--	20.21	--	22.62	0.71
In vitro disappearance					
IVDMD	45.45	60.00	51.07	55.10	2.80
IVOMD	78.90	82.51	69.56	62.39	0.68

Table 6. Effect of biological treatments by *T. viride* F-516, *S. cerevisiae* AFZ-98 and coculture for 21 days on the chemical composition, *IVDMD* and *IVOMD* of Pannae of date palm tree.

Item	Biological treatment				±SE
	Control	*T. viride* (1)	*S. cerevisiae* (2)	Coculture (1+2)	
Dry matter (DM)	92.81	88.62	92.82	88.40	0.53
Organic matter (OM)	89.83	84.91	90.11	84.61	0.26
Ash	10.17	10.42	10.19	10.21	0.26
Crude protein (CP)	5.75	8.44	5.65	9.95	0.27
Crude fiber (CF)	31.25	30.11	31.32	29.86	0.30
Ether extract (EE)	1.89	1.96	2.06	2.24	0.15
Nitrogen free extracted (NFF)	47.68	45.86	47.69	45.17	0.50
NDF	58.46	54.72	56.95	56.05	0.59
ADF	45.15	46.06	46.54	45.09	0.31
Hemicellulose	26.23	23.72	26.24	22.46	0.25
Cellulose	34.10	31.65	34.27	30.60	0.25
Lignin	15.10	15.65	16.27	18.60	0.25
Enzymes (IU / g)					
CMCase	-	6.23	-	7.42	0.62
Xylanase	-	9.7	-	10.40	0.35
In vitro disappearance					
IVDMD	94.49	1.06	50.70	73.70	2.68
IVOMD	72.65	76.38	72.96	78.89	2.60

Table 7. Effect of biological treatments by *T. viride* F-516, *S. cerevisiae* AFZ-98 and coculture for 21 days on the chemical composition, *IVDMD* and *IVOMD* of mid rib of date palm tree.

Item	Biological treatment				±SE
	Control	*T. viride* (1)	*S. cerevisiae* (2)	Coculture (1+2)	
Dry matter (DM)	92.97	89.47	92.27	88.12	0.60
Organic matter (OM)	93.98	91.16	91.01	91.36	0.25
Ash	6.02	6.42	6.14	6.51	0.25
Crude protein (CP)	5.22	8.56	5.62	7.62	0.04
Crude fiber (CF)	40.45	39.55	40.51	39.16	0.42
Ether extract (EE)	0.14	0.18	0.19	2.01	0.01
Nitrogen free extracted (NFF)	47.96	46.27	47.98	45.96	0.44
NDF	72.68	63.51	75.13	71.72	0.39
ADF	54.24	52.40	53.27	51.06	0.38
Hemicellulose	23.21	21.32	23.22	20.86	0.25
Cellulose	39.92	35.16	39.96	34.72	0.25
Lignin	16.93	16.86	16.93	16.24	0.25
Enzymes (IU / g)					
CMCase	-	4.6	-	5.2	0.30
Xylanase	-	4.3	-	6.8	0.75
In vitro disappearance					
IVDMD	38.20	3.82	56.43	60.27	0.83
IVOMD	72.35	75.53	61.74	76.62	0.77

DISCUSSION

Recently, the production of microbial protein from agricultural wastes products has received the attention of several workers. The organism suit able for upgrading the nutritive value of a wastes must be capable of growth in a wide range of carbon sources, have high growth rates to minimize the size of fermentation system and have a high efficiency of conversion of the substrate to biomass with high protein content. *Trichoderma sp.* are familiar in biological treatment of agricultural residues as it have the ability to produce sufficient amount cellulolylic enzymes namely exo, endo-gluconases and β-glucosidase (Fadel, 1983) as well as their ability to produce hemcellulase (Xylanase) Fadel (2001).

The chemical composition of the tested residues showed that it can be classified as lignocellulosic residues. Decreasing in DM, OM, CF and NFE as a result to fungal treatments are different among crop residues can be discussed on the light of the ability of *T. viride* to utilize cellulose and hemicellulose through enzymatic system which could degrade polypolymer in cellulose and hemicellulose to its monomer which can serve as a carbon source by the fungus to produce biomass. Thus the suitability of corn residue to stimulate the cellulose and hemicellulose production consider the limit to upgrade the nutritive value of the crop residue by biological treatment. The data obtained and presented in Tables (2-7) showed the above fact as the decreases in above mentioned parameter can be arrange in a descending order in parallel

with CMCase and xylanase production since, wheat straw, rice straw corn stalks, cotton stalks, pannae and mid rib of date palm produced 8.2, 7.18, 6.3, 8.42, 6.23 and 4.6 and IUCMCase and 12.8, 11.2, 10.6, 20.21, 9.7 and 4.6.

IU xylanase / g substrate respectively. The enrichment in crude protein are attributed to fungus growth on the produced fermentable sugars by the fungal enzymatic system and the available sugars basal medium employed as a moistening agent.

Promising results obtained from corn stalks treated with fungus than the treatment with coculture of fungus and yeast can be discussed on the basis of the xylanase is stimulated by corn stalks (cellulases, though *S. cerevisiae* could not utilize xylose presented in the medium resulted from hemicellulose hydrolysis (Dekkern, 1983).

Many workers used *Trichoderma* sp. to upgrade the nutritive value of lignocellulosic waste. Fadel, 1983 used *T. harzianum* for microbial protein production from rice straw and bagases and could obtained biomass of 32% crude protein. Larwence and Abada (1987) treated rice straw by *T. viride* or *Myrothecium verrucaria* and found a significant decrease in their cellulose content by 12 and 8% respectively. The treatment increased lignin content by 8 and 1% and crude protein content by 3.3 and 4.7% respectively. Kahlon and Doss, 1987 treated wheat straw with two cellulolytic non toxic fungi and reported that, decrease the average of NDF, ADF, cellulose and lignin from 89.7, 63.0, 49.1 and 5.4% in untreated wheat straw to 82.4, 56.2, 40.9 and 4.9% in fungal treated, respectively. Also, Chawla and Kundu (1987) reported the crude protein content of fermented wheat straw by *T. viride* was significantly ($P<0.01$) higher from 3.5% to 23.2% and an increase in crude protein up to 18.3%.

The increase in crude protein production and decrease in cellulose, hemeicellulose, CF and NFE by biological treatment with coculture of *T. viride* and *Saccharomyces cerevisiae* than the treatment by the *T. viride* alone is due to the *S. cerevisiae* consumed the available part of produced fermentable sugars as a result of hydolyzing enzymes of the fungus on substrates and this stimulate the fungus to produce high level of enzyme activities (Aho *et al.*, 1996).

The increase in organic matter and crude protein when the residues were treated with *S. cerevisiae* AFZ-98 not due to the action of yeast on the residue but due to the propagation of yeast biomass when consumed the sugars in basal medium used as a moistening agent as well as the available soluble sugars in the crop residues can be utilized by *S. cerevisiae*.

The above mentioned can explain why the *IVDMD* and *IVOMD* was improvement significantly ($P<0.05$) higher in treatment the crop residues by coculture of fungus and yeast as the higher crude protein content, fiber biodegradation and fiber biotransformation. Thus in the presence of coculture organic matter could be utilized effectively. Many authors reported an increase in *IVDMD* for biological treated crop residues. Rai and Mudgal (1984) reported that an increase in *IVDMD* from 67.9 to 77.5% when treated rice straw with *T. viride* as well as Shoukry *et al.* (1985) found that the treated sugar cane bagasse with *T. viride* increase *IVDMD* from 22.1 to 45.5%. Kornelia (1984) reported that, the *In vitro* digestibility of the bioconverted corn stalks increased from 16 to 22%.

In addition, different biological treatments significantly ($P<0.05$) decreased NDF, ADF and hemicellulose contents the control. However, yeast and combined fungi and yeast treatments showed the highest value of hemicellulose content.

Investigations of the *IVDMD* and *IVOMD* data (Table 6) indicate a significant differences between treatments ($P<0.05$). The highest values were obtained from combined fungi plus yeast and fungi treatments followed by yeast treatments, lowest values were those of control. It is well document that the dry matter digestibility is positively correlated to CP content and negatively correlated to CF, ADF and NDF (Sawe *et al.*, 1998). These results are in agreement with Akin *et al.* (1993).

CONCLUSION

Coculture of *Trichoderma viride* F-516 fungus and *Saccharomyces cerviciae* AFZ-98 could be used successfully to enrich chemical composition well DMD and OMD of cotton stalks and mid rib of date palm tree. However, fungus treatment was the most effective to enrich corn stalks. In addition it should be recorded that either fungus treatment or coculture treatment similar improved the chemical composition, DMD and OMD of wheat straw, rice straw and pinnae date palm tree.

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تأثير المعاملات الكيميائية والبيولوجية لبعض مخلفات الحقل علي قيمتها الغذائية. ٢- تأثير المعاملات البيولوجية علي التركيب الكيمائى ومعامل الهضم المعملى.

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تم استخدام ستة مخلفات محاصيل وهى تبن القمح – قش الأرز – حطب القطن – حطب الذرة – خوص النخيل وجريد النخيل ومعاملتها بالمعاملات البيولوجية باستخدام التخمر الجاف لرفع قيمتها الغذائية للمساهمة بجزء في علائق المجترات. تم رفع رطوبة المخلفات بنسبة ١ : ٢ للمخلف بواسطة البيئة السائلة والتى تتكون من ٤% مولاس ، ٠,٤ % يوريا ، ٠,٢% فوسفات بوتاسيوم أحادية الهيدروجين و ٠,٠٣% كبريتات ماغنسيوم. تم تحضين المخلفات المضاف لها البيئة مع ١٠% (حجم إلي وزن) فطر *Trichoderma viride* أو خميرة *Saccharomy-ces cerevisiae* و٥% (حجم إلي وزن) بكل منهما وتم تحضين المخلفات المعاملة علي درجة حرارة الغرفة (٣٠°± ٢) لمدة ٢١ يوم.

ارتفع محتوى البروتين الخام في كل من تبن القمح وقش الأرز وحطب القطن وخوص وجريد النخيل المعامل بالفطر والمعامل بالخميرة ومن جهة أخرى المعاملة بالفطر كانت الأفضل بالنسبة لحطب الذرة. كان الفقد في المادة الجافة الراجع للمعاملات البيولوجية ١١% لحطب الذرة يليه قش الأرز (٩%) ثم تبن القمح (٨%). وكان الانخفاض في كل من خوص وجريد النخيل ٤,٣٧ و ٢,٥٥% علي الترتيب.

المعاملات البيولوجية خفضت مكونات الألياف الخام NDF ، ADF معنوياً ، وارتفعت القيمة الغذائية للمخلفات المعاملة بيولوجياً في صورة معامل الهضم المعملى للمادة الجافة لكل من تبن القمح وقش الأرز وحطب القطن ، وحطب الذرة وخوص وجريد النخيل من ٦٤,٣٩ ، ٦٢,٤٥ ، ٧٣,٠٤، ٧٨,١ ، ٧٢,٦٥ ، ٧٢,٣٥ قبل المعاملة إلي ٨١,٢١ ، ٧٢,٤ ، ٨٠,٨٧ ، ٨٢,٥١ ، ٧٨,٨٩ ، ٧٦,٠٢ علي التوالى بعد المعالجة البيولوجية.