

PRODUCTION PERFORMANCE OF SMALL RUMINANTS FED PRUNING FRUITS TREES BY PRODUCTS. 2- EFFECT OF TREATED PRUNING PEACH TREES BY-PRODUCTS ON GROWING SHEEP.

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ABSTRACT

This experiment was conducted to study the effect of chemical and biological treatments of pruning peach trees by-products (PTBP) on chemical composition, degradability, cell wall constituents, digestibility and nutritive value and its feeding effect on productive performance of growing sheep. Thirty Ossimi lambs with average body weight 18.00 ± 0.20 kg and 4 months old were used in this study for 120 days. Lambs were distributed into five similar groups (6 lambs each) and randomly assigned to five experimental rations. The five respective rations composed of concentrate feed mixture (CFM) + roughage (PTBP), the control ration (R1) contained untreated PTBP; (R2) treated PTBP with *Trichoderma reesei*; (R3) treated PTBP with *Trichoderma viride*; (R4) treated PTBP with *Trichoderma reesei* + *Trichoderma viride* and (R5) 3% urea treated PTBP. The DM, OM and CP disappearance and effective degradability (ED) values were *in situ* determined. The digestibility and nutritive values of experimental rations were determined using fifteen adult Ossimi rams. Rumen liquor and blood samples were collected at the end of collection period. The results showed that fractions of DM (a&b) and (ED) were significantly ($P < 0.05$) increased with treated PTBP either with urea or fungi compared to control (untreated PTBP). The highest degradable values of DM, OM and CP were observed with R4. Nutrient digestibility and feeding values (TDN and DCP) were higher ($P < 0.05$) for rations containing treated PTBP than control. The highest values of TDN and DCP were observed for R4. Digestibility of cell wall constituents (NDF, ADF, cellulose and hemicellulose) were improved by treatments. Concentrations of rumen parameters ($\text{NH}_3\text{-N}$ and TVFA's) were significantly increased by treatments. However, no significant differences were found in blood constituents (total protein, albumin, globulin, GOT, GPT and urea) among the different experimental groups. Blood constituents were generally normal in all experimental groups. Growth performance with respect to total body weight gain and average daily gain (ADG) were improved by biological treatments. The same trend was observed for feed conversion and economic efficiency and the best values were recorded with R4. It was concluded that inclusion of treated PTBP to rations of growing Ossimi lambs could improve their performance especially treatment of PTBP with fungi.

Keywords: Peach trees by product, biological treatments, fungus, digestibility, blood and rumen parameters, urea, degradation kinetics, sheep, growth.

INTRODUCTION

In Egypt, there is a wide gap between the available feedstuffs and farm animal requirements. Part of these needs can be covered by agricultural residues which include cereals crops and leguminous hays, cotton field's residues, vegetable crops residues, and waste products of pruning trees. The primary factors limiting the utilization of crop residues are their low digestibility, low protein content and low palatability. The low digestibility is

attributed to high cellulose content (30-40%), hemicellulose (25-35%) and lignin (10-15%) in the dry matter (Theander and Aman, 1984). Živković *et al.* (2013) and Bilandzija *et al.* (2012) reported that peach trees are important sources of pruning residues. They added that the amount of by-products after pruning remains in peach was 6.88-7.23 kg per tree. Taking into account the planting distance (number of tree per hectare) the amount of pruning by product of peach was 2.87-3.37 ton per hectare (approximately 1.17-1.36 ton per acre). In Egypt, peach are cultivated in an area of 67.7 thousand feddans (Egyptian Ministry of Agriculture, 2012) and produce considerable quantities of by-products. Most of these residues are burned or wasted, and hence lead to environmental pollution and consequently health hazards.

The waste agricultural residues mostly consist of poly-saccharides which are poorly digested by ruminants due to the presence of lignin which is recalcitrant to microbial degradation. Lignin also constitutes a physical barrier to the extraction and utilization of other components. The physical barrier of lignin can be broken either by physical, chemical or biological treatments (Belewu and Popoola, 2007). The chemical treatments, which has been used to improve palatability and digestibility of nutrients in crop residues include urea treatment that was reported earlier (Hart and Wanapat, 1992; Khan *et al.*, 1999 and Dass *et al.*, 2000). This treatment also provides non-protein nitrogen (NPN) to ruminants diets (Jakson, 1977). Biological treatment is used for increasing the nutritional value of many by-products, because they have significant concentrations of simple carbohydrates, such as mono- and disaccharides. For these reasons, the microbial conversion of these wastes can improve their nutritional value and transforming them into animal feed with high quality (Villas-Boas *et al.*, 2002). Most fungi are capable of degrading various varieties of substrates (Sancholle and Losel, 1995) and their role in the nutrition of animal (Belewu and Belewu, 2005 and Belewu, 2006). Moreover, Akinfemi and Ladipo (2013) showed that fungal treatment of sawdust enhances its nutrient contents and *in vitro* digestibility. The biological and urea treatments of grape trees by-products improved nutrients digestibility and nutritive values (under publication). Fungus treatments can be successfully used to enrich cotton stalks and improve the nutritive value (Deraz and Ismail 2001 and Mahrous, 2005)

The objectives of this study were to investigate the effects of fungal or urea treatments of pruning peach trees by-products on chemical composition, digestibility, nutritive value and growth performance of Ossimi lambs and its economic efficiency.

MATERIALS AND METHODS

The experimental work of this study was carried out at Seds Experimental Station, Animal Production Research Institute, Agriculture Research Center. Thirty Ossimi lambs at four months of age with an average live body weight of 18 ± 0.2 kg were randomly assigned to five groups according to live body weight (6 lambs for each). Animals in all groups were fed rations consisting of concentrate feed mixture (CFU) to cover their maintenance requirements according to NRC (1985) recommendations while,

pruning trees by-products (PTBP) were offered *ad lib*. The animals were fed the five respective rations in two meals /day (8 am and 3 pm). *Trichoderma reesei* (*T. reesei*) and *Trichoderma viride* (*T. viride*) were obtained from the Microbial Chemistry Department, National Research Center, and Dokki, Egypt. The microorganisms were preserved on Potato Dextrose Agar (PDA) medium at 25 °C until used.

The PTBP was chopped into 3-5 cm then packed till using. Fifty grams of residue under investigation were weighed, packed in heat resistant bags (10 x 20 cm) and sterilized by autoclaving at 121 °C for 30 minutes. Spore suspension of *T. reesei* and *T. viride* were prepared and used to inoculate a sterilized liquid medium containing (g/L) 4% molasses, 0.4% urea, 0.2% KH_2PO_4 and 0.03% $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ and incubated for 7 days. Urea-treated PTBP was prepared by using 3 kg urea of fertilizer grade (46% N) plus 50 liter water sprayed onto 100 kg of PTBP and then covered up for 21 days before directly feeding to the animals. The fungal treated PTBP was moistened to 65 – 70% and put specific fungal spawn and left for three weeks. The untreated and the treated PTBP were analyzed for (DM), crude protein (CP), ether extract (EE), crude fiber (CF) and ash content according to the A.O.A.C (1995). Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined by the methods of Van Soest (1982).

Three ruminally cannulated Ossimi rams were used for the *in situ* trials. Nylon bags technique (Mehrez and Ørskov, 1977) was used to determine DM, OM and CP disappearance of roughage. Two polyester bags (7×15 cm) with pore size of 45µm were used for each incubation time; approximately 5g of air dried roughage (ground to 2mm) were placed in each bag. Bags were incubated in rumen of each sheep and withdrawn after 3, 6, 12, 24, 72, and 96 h. After the bags were withdrawn from the rumen, they were rinsed in tap water until the water became clear, then they were squeezed gently. Microorganisms attached to the residual samples were eliminated by freezing at -20° C (Kamel *et al.* 1995). Zero time washing losses (A) were determined by washing 2 bags in running water for 15 min. The degradation kinetics of DM, OM and CP were estimated (in each bag) by fitting the disappearance values to the equation $P = a + b(1 - e^{-ct})$ as proposed by Ørskov and MacDoland (1979), where P represents the disappearance after time (t). Least squares estimated soluble fractions are defined as the rapidly degraded fraction (a), slowly degraded fraction (b) and the rate of degradation (c), respectively. The effective degradability (ED) for the tested were estimated from the equation cited by McDonald (1981), $ED = a + bc / (c + K)$, where k is the out flow rate assumed to be 0.03/hr (Ørskov and Ryle, 1990).

A digestibility trial was conducted using fifteen adult Ossimi rams and divided into five similar groups (3 animals for each) averaged 55kg and 3 years old. Animals were housed in individual metabolic cages for 21 days (14 days as a preliminary period followed by 7 days as collection period) to determine the digestibility coefficients and nutritive values of the five tested rations. The five groups titled R1: untreated PTBP (control); R2: PTBP treated with *T. reesei*; R3: PTBP treated with *T. viride*; R4: PTBP treated with

(*T. reesei* + *T. viride*) and R5: PTBP treated with 3% urea. All groups were fed PTBP untreated or treated *ad. Lib.* Feces were collected quantitatively every day and 10% daily sample was taken and sprayed with 10% sulfuric acid and dried during the collection period. At the end of the collection period, feces samples for each ram were ground mixed well and kept in the refrigerator till its chemical analysis. Rumen liquor samples were taken from each animal at the end of collection period by stomach tube at 0, 3 and 6 hrs. post-feeding. The ruminal pH values were measured immediately by pH meter (Orion Research, model 201/digital pH meter). Ammonia nitrogen (NH₃-N) concentration was measured according to Conway and O'Mally (1957). Total VFA's concentration was determined by the steam distillation method according to Abou-Akkada and Osman (1967). Blood samples were collected from the jugular vein at 3 hrs. post-feeding and centrifuged for 20 min. at 3000 r.p.m. The supernatant was frozen and stored at -20°C for subsequent analysis. Plasma total protein was determined according to Armstrong and Carr (1964); albumin according to (Doumas *et al.*, 1971); GOT and GPT according to (Reitman and Frankel, 1957); and urea according to (Siest *et al.*, 1981).

Collected data were subjected to statistical analysis using one-way-analysis of variance according to Snedecor and Cochran (1980) using the following model:

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

Where: Y_{ij} is the parameter under analysis, μ is the overall mean, T_i is the effect due to treatment and e_{ij} is the experimental error. The general linear model of SAS (2001) program was used in processing measured parameters. The difference between means was statistically measured for significance at ($P < 0.05$) according to Duncan's test (1955).

RESULTS AND DISCUSSION

Chemical composition:

Table (1) shows the effect of chemical and biological treatments on chemical composition and cell wall constituents of pruning peach trees by products (PTBP). The present data indicated that the values of DM, OM, CF and NFE were decreased in treated PTBP; however, CP was increased from 3.34% for untreated PTBP to 5.8, 6.41, 7.32 and 5.20% for *T. reesei* (T2), *T. viride* (T3), *T. reesei*+ *T. viride* (T4) and urea (T5) treatments, respectively. The same trend was observed with ash content since it increased either with urea or fungal treated PTBP. Results are in agreement with those obtained by Mahrous *et al.* (2010&2011) and El-Ashry *et al.* (2002) who reported that in fungal treated residues (sugarcane bagasse, wheat straw, cotton stalks, pinnae and mid ripe of date palms), CP and ash contents were increased but DM, OM, CF and NFE contents were decreased. Also, Fayed *et al.* (2009) reported that urea or fungal treatment of olive leaves led to decrease CF content; meanwhile, CP and ash contents were increased in comparison with those for untreated olive leaves.

Table (1): Chemical composition and fiber fractions of untreated and treated pruning peach trees by-products and CFM (% on DM basis).

Item	Treatments					CFM
	T1	T2	T3	T4	T5	
Chemical composition:						
DM	91.56	89.30	88.41	87.60	90.20	88.7
OM	90.64	85.80	86.48	85.38	87.21	92.82
CP	3.34	5.80	6.41	7.32	5.20	14.16
CF	53.53	48.37	47.20	46.32	49.11	11.05
EE	0.67	1.10	1.80	1.18	0.83	2.3
NFE	33.10	30.53	31.01	30.56	32.07	65.31
Ash	9.30	14.20	13.58	14.62	12.79	7.18
Cell wall constituents:						
NDF	81.65	77.32	77.80	74.20	78.30	27.79
ADF	67.72	63.22	62.94	59.31	64.15	8.86
ADL	37.84	28.30	28.10	26.05	30.46	2.89
Cellulose	29.88	34.92	34.84	33.26	33.69	5.88
Hemicelluloses	13.93	14.10	1.86	14.89	14.15	18.89

* Concentrate feed mixture (CFM) consisted of: 38% ground yellow corn, 22% undecorticated cotton seed meal, 7% soybean meal, 12% wheat bran, 13% rice bran, 5% cane molasses, 2% lime stone and 1% common salt. T1: un-treated PTBP; T2: PTBP treated with *T. reesei*; T3: PTBP treated with *T. viride*; T4: PTBP treated with *T. reesei*+*T. viride* and T5: PTBP treated with urea.

Chandra *et al.*(1991) claimed that the content of OM decreased as a reflection of CF decreasing which was utilized by fungi (*T. viride*, *A. niger* and mixed fungi) while, the increase in ash content was inversely related to the loss OM content of treated paddy straw. Salman *et al.* (2011) reported that CP content increased in chemical (urea) or biological (fungi and bacteria) treated sugarcane bagasse. This effect may be mainly due to nitrogen content of added urea in chemical treatments or microbial protein in biological treatment as a result of growing fungi. The decrease in CF content of the experimental roughage could be resultant of the enzymes secreted by bacteria or fungi in biological treatments (Gado *et al.*, 2007). However, Abd El-Ghani *et al.* (1999) indicated that CF content was decreased by urea treatment which was mainly due to the liberation of cellulose from its bonds with lignin (delignification) which increased their solubility. Chandra *et al.* (1991) mentioned that the increase of ash in chemical or biological treatments reflected the decrease in CF and NFE contents.

The NDF, ADF and ADL decreased after the treatment of PTBP by either chemical or biological treatments. The NDF values were decreased by about 5.30, 4.72, 9.12 and 1.25% and the corresponding values of ADF were 6.65, 7.06, 12.42 and 5.27% for, T2, T3, T4 and T5 respectively. While the values of cellulose and hemicelluloses were increased by treatments. These findings agree with those found by Akinfemi and Ladipo (2013) who observed reductions in NDF, ADF and ADL values as a result of fungal treatment of sawdust. Fungal treatment depleted the hemicellulose fraction compared with control, whereas, the cellulose fraction was significantly increased. Also,

Mahrous *et al.* (2010&2011) reported that the biological treatment (*T. viride*) of sugarcane bagasse resulted in decreasing NDF and ADF, while cellulose and hemicellulose were increased. Fayed *et al.* (2009) showed that urea treatment and biological treatment decreased all fiber fractions of pruning olive trees by-products. However, Verma *et al.* (2006) found that urea treatment of wheat straw substantially enhanced the content of ADF and cellulose, while, the content of hemicellulose and NDF were decreased. The incubation of sawdust with fungus reduced the crude fiber content and fiber fraction probably due to enzymatic action of the fungus on fiber (Belewu, and Popoola, 2007). Fungi cultivation decreased the amount of NDF and ADF in wheat straw and barley straw, while, ADL content did not differ by treating with fungi (Nasehi *et al.*, 2014).

Degradation kinetics:

Degradability kinetics of DM, OM and CP for peach trees by products in the rumen of sheep are presented in Table (2).

Table (2): Degradation kinetics of DM, OM and CP for un-treated and treated peach trees by-products in rumen of sheep.

	T1	T2	T3	T4	T5	±SE
DM						
a	17.81 ^d	20.96 ^b	21.26 ^b	22.71 ^a	19.30 ^c	0.180
b	31.43 ^d	36.61 ^b	37.72 ^a	37.27 ^a	32.35 ^c	0.312
c	0.050	0.052	0.050	0.052	0.053	0.002
μ	50.16 ^a	42.88 ^c	41.02 ^d	40.01 ^e	48.35 ^b	0.326
ED	40.27 ^e	46.91 ^c	47.65 ^b	49.35 ^a	42.82 ^d	0.146
OM						
a	13.83 ^d	18.75 ^b	18.97 ^b	20.02 ^a	15.69 ^c	0.219
b	32.83 ^d	37.66 ^a	38.09 ^a	36.77 ^b	35.12 ^c	0.261
c	0.047 ^c	0.047 ^c	0.050 ^{bc}	0.058 ^a	0.053 ^{ab}	0.002
μ	53.34 ^a	43.60 ^c	42.93 ^c	43.21 ^c	49.19 ^b	0.258
ED	36.74 ^e	44.98 ^c	46.25 ^b	47.39 ^a	40.84 ^d	0.109
CP						
a	9.24 ^e	14.06 ^b	12.69 ^c	14.56 ^a	11.55 ^d	0.168
b	33.83 ^d	36.58 ^a	35.20 ^{bc}	35.89 ^{ab}	34.52 ^{cd}	0.360
c	0.050	0.052	0.052	0.050	0.050	0.001
μ	56.94 ^a	49.37 ^d	52.11 ^c	49.52 ^d	53.92 ^b	0.255
ED	33.21 ^d	38.06 ^b	40.29 ^a	40.11 ^a	36.10 ^c	0.109

^{a,b,c,d} and ^e Means in the same row with different superscript letters are significantly (P<0.05) different.

a: soluble fraction(%); b: potentially degradable fraction(%); c: rate of nutrient degradation(%h⁻¹); μ: un-degradable fraction [μ=100-(a+b)] ; ED: effective degradability=a+[bc/c+ k], where k is the out flow rate assumed to be 0.03/hr.T1: un-treated PTBP; T2: PTBP treated with *T. reesei*; T3: PTBP treated with *T. viride*; T4: PTBP treated with *T. reesei* +*T. viride*; and T5: PTBP treated with urea.

The soluble fractions (a) and (b) values of DM, OM and CP were significantly (P<0.05) higher either for urea or fungal treated PTBP than that for un-treated PTBP. The highest values were observed for fungal treatments followed by urea treatment. There were no significant (P<0.05) differences of (c) degradable values among all groups for DM and CP. While, the

degradation rate (c) of OM significantly ($P < 0.05$) increased when PTBP was treated with the two fungi (T4) or urea treatment. The highest un-degradable fraction (u) values of DM, OM and CP were noticed with T1 (untreated PTBP) followed by urea then fungal treated PTBP. The effective degradability (ED) values of DM, OM and CP were significantly ($P < 0.05$) increased with all treatments and the highest values were observed with T4 compared with the control (T1). Similar results have been reported by Shoukry et al. (1985) who reported that in vitro and in situ DM disappearance increased for sugarcane bagasse treated with *T. viride*. IN the same trend, DM and OM degradability were significantly ($P < 0.05$) increased for either rice straw or corn stalks treated with *T. viride* compared to those for untreated one (Abdel-Azim et al., 2011). Also, Gado (1999) and Abo-Eid et al. (2007) reported that in vitro and in situ trials DM and OM degradability were increased ($P < 0.05$) for all tested crop residues (rice straw, bagasse, wheat straw, cotton stalks and corn stalks) treated with *T. reesei* compared to the un-treated ones. Generally, urea and fungal treatments increased degradability of PTBP. Similar results have been reported by Bassuny et al. (2003a) who reported that the values of in vitro digestibility were improved by fungal, chemical and biochemical treatments for some crop residues (corn cobs and sugarcane bagasse) compared with control values, the best efficiency was obtained by urea plus fungi followed by fungi then urea treatment. Also, Salman et al. (2011) found that the best in vitro OM digestibility values were observed with either fungal or bacterial treated bagasse followed by that for 3% urea treated bagasse.

Digestibility coefficients and feeding value:

Digestion coefficients and feeding values of experimental rations are presented in Table (3). Data revealed that urea and fungal treatments had significantly higher ($P < 0.05$) digestibility values for all nutrients; however; the highest value was achieved with fungal treated PTBP especially with R4. Digestibility of cell wall constituents (NDF, ADF, cellulose and hemicellulose) were increased by urea and fungal treatments and the best value was observed for R4. These results are in agreement with those obtained by Abdel-Malik *et al.* (2003) who reported that digestibility of DM, OM, CP, CF, NFE, NDF, ADF, cellulose and hemicellulose were significantly increased ($P < 0.05$) for banana by products treated with either chemical (urea or acid plus urea) or biological treatments (bacteria, fungi, or bacteria plus fungi) in comparison with those for untreated one. Also, Deraz (1996); Zewil (2005); El-Kady *et al.* (2006) and Allam *et al.* (2006b) reported that animals fed biologically treated roughages were almost most efficient followed by those fed chemically treated roughages. The digestibility of CF, NDF and cellulose were higher ($P < 0.05$) with urea treated banana wastes than the control (untreated), but it was lower than biologically treated roughage (Hassan *et al.*, 2005). The fungi treatments had the effect of loosening lingocellulitic bond and solubilize some of hemicellulose content (Hammouda, 1996; El-Ashry *et al.*, 1997 and Fouad *et al.*, 1998). Silva and Ørskov (1998) reported that urea treatment increased the nutritional value of wheat straw by making more digestible cellulose and hemicellulose available. This creates favorable conditions in the rumen for developments of the cellulolytic bacteria which

specialized in degrading the cell wall. Moreover, urea treatment increased the degradable fraction of straw, as well as the rate of degradation (Nandra *et al.*, 1983 and Ibrahim *et al.*, 1989).

Table (3): Effect of biological treatments on apparent digestibility and feeding values of experimental rations.

Item	Experimental rations					± SE
	R1	R2	R3	R4	R5	
Digestibility, %:						
DM	52.45 ^d	58.28 ^b	60.01 ^a	61.46 ^a	54.90 ^c	0.501
OM	52.22 ^d	60.41 ^b	61.76 ^b	64.06 ^a	56.45 ^c	0.420
CP	52.21 ^c	62.25 ^a	63.26 ^a	64.33 ^a	57.23 ^b	0.760
CF	47.97 ^c	53.31 ^b	55.83 ^b	61.80 ^a	53.91 ^b	1.641
EE	72.44 ^b	76.15 ^{ab}	77.26 ^{ab}	82.16 ^a	70.44 ^b	2.180
NFE	53.41 ^c	63.11 ^a	63.46 ^a	64.56 ^a	56.70 ^b	0.580
Cell wall constituents, %						
NDF	45.15 ^d	53.51 ^{bc}	55.59 ^b	58.52 ^a	52.51 ^c	0.075
ADF	34.20 ^d	41.67 ^b	41.67 ^b	43.18 ^a	38.81 ^c	0.448
ADL	20.30	21.32	20.58	21.22	21.11	0.662
Cellulose	48.61 ^c	55.96 ^a	56.74 ^a	57.86 ^a	52.36 ^b	0.799
Hemicellulose	62.90 ^c	76.08 ^a	76.28 ^a	78.18 ^a	70.88 ^b	1.055
Feeding value, %						
TDN	49.30 ^e	56.58 ^c	58.05 ^b	60.35 ^a	52.26 ^d	0.361
DCP	5.54 ^d	6.81 ^c	7.30 ^b	7.89 ^a	6.73 ^c	0.075

^{a,b,c,d} and ^e Means in the same row with different superscript letters are significantly ($P < 0.05$) different.

Feeding values (TDN and DCP) of experimental rations that contained PTBP treated with urea or fungi had higher values ($P < 0.05$) than untreated PTBP (R1). However, rations contained fungal treated PTBP had significantly higher values compared with urea treatment ration especially; R4 which recorded the highest values among all rations (Table 3). These results revealed that fungal treatment was more effective for improving digestibility and feeding value of PTBP than urea treatment. Similar results were obtained by Salman *et al.* (2011) who reported that TDN and DCP of bagasse were improved by different treatments with the superiority of fungi or biochemical treatments compared with urea treatment. This improvement of feeding values for urea or biologically treated rations may be due to the improvement of most nutrient digestibility of treated rations. While the increase of DCP by treatment may be due to the increase CP level, protein quality and its digestibility as a result of urea or urea plus fungal treatments (Salman *et al.*, 2011). Also, Bassuny *et al.* (2003b). Aziz *et al.* (2008) found that urea treatment and biological treatment (*T. viride* and *Saccharomyces cerevisiae*) increased both TDN and DCP compared to untreated group.

Nitrogen balance:

Nitrogen intake, N-excreted and N-balance by sheep fed different experimental rations are presented in Table (4). Data revealed that different values of nitrogen terms were significantly ($P < 0.05$) affected by chemical or biological treatments. N-intake values were higher for sheep fed ration

containing treated PTBP compared with control (untreated PTBP). The highest value of NI was observed with R4 followed by R5 and no significant differences were noticed among R1, R2 and R3. All sheep were in a positive nitrogen balance (NB), however; biological treatments (R2, R3 and R4) had higher ($P<0.05$) values of NB/NI and NB/NA% followed by urea treatment compared with the control one. So, better N-utilization was achieved from treated rations. These findings are in agreement with those obtained by El-Ashry *et al.*(1997); Khorshed (2000); Aziz *et al.*(2008); Farghaly (2009) and Salman *et al.*(2011), who reported that animals (sheep& goats) fed ration contained biologically (fungi, yeast, bacteria and combined of them) treated crop residues (cotton stalks, wheat straw and sugarcane bagasse) had higher positive N-balance. Also, Fayed *et al.* (2009) reported that feeding biological (*T. viride* + *S. cerevisi*) and urea treatment of pruning olive trees by-products had higher N-balance value than untreated one.

Table (4): Nitrogen utilization (g/h/d) by sheep fed experimental rations.

Item	Experimental rations					± SE
	R1	R2	R3	R4	R5	
Nitrogen intake(NI), g/h/d	10.90 ^c	11.19 ^{bc}	11.55 ^{bc}	13.48 ^a	12.82 ^{ab}	0.528
Fecal nitrogen, g/h/d	5.21 ^{ab}	4.22 ^c	4.42 ^{bc}	4.81 ^{abc}	5.49 ^a	0.279
Urinary nitrogen, g/h/d	2.69	2.38	2.22	2.50	2.71	0.233
N absorbed (NA), g/h/d	5.69 ^c	6.97 ^b	7.13 ^b	8.67 ^a	7.33 ^b	0.300
N balance (NB), g/h/d	3.00 ^c	4.59 ^b	4.91 ^{ab}	6.17 ^a	4.62 ^b	0.444
NB/NI, %	27.52 ^c	41.02 ^{ab}	42.51 ^{ab}	45.77 ^a	36.04 ^b	2.748
NB/NA, %	52.72 ^c	65.85 ^{ab}	68.86 ^{ab}	71.16 ^a	63.034 ^b	4.482

^{a, b, c and d} Means in the same row with different superscript letters are significantly ($P<0.05$) different.

It seems that biological treatments improved nitrogen balance as a result of less nitrogen excretion. The highest nitrogen balance by feeding urea treatment may be due to the improvement in the CP digestibility and higher utilization of urea nitrogen by sheep (Fayed *et al.*, 2009). On the other hand, biological treatment improved chemical structure, chemical composition (El-Ashry *et al.*, 2001 and Fayed *et al.*, 2009), digestibility, feeding value and N- balance of treated wastes (Hassan *et al.*, 2005 and Hamza *et al.*, 2006). Walli *et al.* (1988) observed that the N intake, its digestion and retention by cross-bred calves fed fungal treated wheat straw was higher than those fed urea treated wheat straw.

Rumen liquor parameters:

Rumen fluid parameters are shown in Table (4). No significant ($P>0.05$) differences were found for ruminal pH values among experimental groups at different times. However, concentrations of NH_3-N were significantly ($P<0.05$) higher for rams fed rations contained either urea or biologically treated PTBP than the control ration (untreated PTBP) at 3 and 6 hr. post-feeding. The highest values of NH_3-N were observed with R5 and R4. The present results are supported by those of Abo-Eid *et al.* (2007) who reported that ruminal ammonia was significantly ($P<0.05$) higher for rams fed rations containing biologically (*T. reesei*) treated roughage (rice straw, corn stalks, olive pulp and date seeds) than those fed untreated ration. Ammonia reached the maximum concentrations at 3 hr. post-feeding for all treatments

and the lowest values was at zero time. Also, Bassuny *et al.* (2003b) and Fayed *et al.* (2009) found that rams fed ration contained urea treated roughage had the highest NH₃-N concentration followed by those fed ration contained biologically treated roughage.

The increase of ammonia nitrogen by urea treatment may be due to the high NPN content which is easily converted to NH₃-N during fermentation. However, the increase in NH₃-N with biological treatment could be a result of breakdown of protein and other nitrogenous compound to NH₃-N (Fayed *et al.*, 2009).

Table (5): Rumen liquor parameters for animals fed the experimental rations.

Item	Time (hrs.)	Experimental ration					± SE
		R1	R2	R3	R4	R5	
pH	0	6.61	6.82	6.69	6.76	6.70	0.062
	3	6.22	6.38	6.25	6.40	6.47	0.016
	6	6.58	6.77	6.63	6.71	6.56	0.125
NH ₃ -N(mg/100ml)	0	15.79	17.37	15.97	17.93	17.65	1.472
	3	20.55 ^c	28.29 ^b	26.17 ^{bc}	33.89 ^a	34.99 ^a	0.752
	6	18.12 ^b	20.64 ^{ab}	19.61 ^b	21.48 ^{ab}	24.75 ^a	1.869
TVFA's(meq./100ml)	0	8.33 ^d	10.13 ^b	10.49 ^b	11.81 ^a	9.22 ^c	0.248
	3	9.89 ^d	12.96 ^b	13.59 ^b	15.15 ^a	11.54 ^c	0.339
	6	7.57 ^c	11.21 ^b	11.12 ^b	13.38 ^a	8.01 ^c	0.664

^{a, b, c} and ^d Means in the same row with different superscript letters are significantly (P<0.05) different.

Data in Table (4) indicated that TVFA's concentrations were significantly increased (P<0.05) by feeding rations contained urea or biologically treated PTBP compared with the control (R1). On the other hand, biological groups had higher TVFA's concentration than urea group; especially R4 which had the highest concentration of TVFA's. Generally, concentrations of TVFA's reached to the highest values at 3 hr. post-feeding then declined at 6 hr. post-feeding and the lowest values were noticed at zero time. These results are in agreement with those obtained by Bassuny. (2003b) who recorded that the highest concentration of TVFA's was observed with rams fed ration contained biological treated roughages followed by those received urea treated roughage compared to the control. Also, El-Sayed *et al.* (2002) and Mahrous and Khorshed (2012) reported that animals (sheep & goats) fed rations contained biologically (*T. viride*, *S. cerevisiae*, *T. reesei*, *P. funiculosms* and *T. reesei* + *P. funiculosms*) treated roughage (corn stalk and sugarcane bagasse) had higher (P<0.05) concentrations of TVFA's than those fed control ration which indicated better fermentation in the rumen.

Kumar *et al.* (1997) and Bassuny *et al.* (2003b) attributed the increase in concentration of TVFA's as a result of using biological treatment to the high fiber breakdown. Also, Doane *et al.* (1997) reported that TVFA's production was correlated with NDF disappearance and higher concentration of TVFA's in the rumen of biological treatment may be a result of altered rumen microbial populations and microbial activity. However, Allam *et al.*

(2006b) reported that TVFA's concentrations in rumen is governed by several factors, such as DM digestibility, rate of absorption, rumen pH, transportation of the digesta from rumen to other parts of digestive tract and the microbial population in the rumen and their activity.

Blood parameters:

Blood plasma parameters for rams fed experimental rations are illustrated in Table (6). The present data showed insignificant ($P<0.05$) differences among the different experimental rations for blood plasma total protein, albumin, globulin, urea, GOT and GPT. However, blood plasma total protein and urea were insignificantly increased for rams fed urea or fungi treated PTBP compared to those fed control ration (untreated PTBP). These insignificant increases of blood plasma total protein and urea may be due to the increase of N-intake and its higher digestibility which reflected on ruminal $\text{NH}_3\text{-N}$ and finally the blood plasma constituents. These results are in agreement with those obtained by Deraz and Ismail (2001) and Mahrous *et al.* (2011) who found that no significant differences were noticed in blood plasma parameters among all groups fed untreated or fungal treated crop residues and the values were within the normal range. Also, Hassan *et al.* (2005) found no significant differences among groups concerning all blood constituents for dairy cows fed untreated or biologically treated banana wastes. On the other hand, the present results disagree with those obtained by Bassuny *et al.* (2003b) who found that blood components were significantly affected ($P<0.05$) by treatments. The higher values of total protein, albumin, urea, GOT and GPT were recorded with urea + fungi treatment followed by urea treatment compared to untreated group.

Table (6): Blood plasma parameters for rams fed experimental rations.

Item	Experimental ration					±SE
	R1	R2	R3	R4	R5	
Urea (mg/100ml)	26.15	28.09	27.83	28.06	28.74	3.125
Total protein (g/100ml)	7.65	7.70	7.70	7.74	7.71	0.392
Albumin (g/100ml)	3.86	3.87	3.85	3.96	3.99	0.105
Globulin (g/100ml)	3.79	3.84	3.86	3.77	3.73	0.317
GOT (U/L)	21.15	21.83	21.70	20.75	21.52	0.858
GPT (U/L)	33.15	33.87	34.01	34.09	34.89	2.192

The present values of blood plasma constituents for all experimental groups were within the normal range for healthy sheep reported by Cornelius (1970) and Merck (1991). It is of interest to recognize that either urea or fungal treatments had no adverse effect on liver function and lambs were found to be healthy under such feeding program.

Growth performance and economic efficiency:

Data in Table (7) indicated that although the initial body weight of lambs of all groups were similar yet the final body weight, total gain and daily gain were significantly ($P<0.05$) higher for lambs fed rations contained fungal treated PTBP than those fed untreated PTBP (control). However, lambs fed urea treated PTBP had insignificant higher final body weight, total gain and daily gain compared with control. These results are in agreement with Shaker

et al. (2011) who reported that lambs fed barley straw treated with fungi had higher ($P < 0.05$) final body weight and daily gain (39.76 kg and 228 g d⁻¹) as compared with those fed untreated straw (34.8 kg and 154 g d⁻¹). While, lambs fed urea treated barley straw showed insignificant difference (35.0 kg and 166 g d⁻¹). Also, Fayed *et al.* (2012) showed that average daily gain for lambs fed ration contained potato veins treated with fungi (*T. reesei*) was higher ($P < 0.05$) than those fed control ration (untreated potato veins).

Fayed *et al.* (2012) reported that the effect of fungal treatment on increasing final body weight and daily gain was mainly due to the improving in digestibility, metabolizable energy content and palatability. Also, Belewu and Popoola (2007) recorded that significant ($P < 0.05$) higher values of weight gain for lambs fed fungal treated based diet could be due to higher feed intake and the sawdust was predigested by the fungus before its inclusion in the diet. Moreover, Abdel-Azim *et al.* (2011) claimed that fungal (*T. viride*) treated rice straw and corn stalks improved their feeding values resulting in higher intake, N-balance and growth rate in cross-bred lambs.

Average dry matter intake (DMI) was higher for lambs fed R4 (PTBP treated with *T. reesei*+*T. viride*) followed by R3, R2 and R5 compared to R1 (Table 7). It was observed that DMI from the roughage was increased following the treatment of either with the fungus or urea. Meantime, more roughage intake was seen with the fungi treatment roughage than from those treated with urea. These results are in agreement with those obtained by Aziz *et al.* (2008) and Shaker *et al.* (2011) who reported that DMI of lambs fed urea and biologically (*Phanerocheate chrysosporium*, *T. viride* and *Pleurotus ostreatus*) treated roughage (olive tree by product and barley straw) was significantly increased as compared with the control. Also, Gado (1999) and Belewu and Popoola (2007) reported that DMI was higher ($P < 0.05$) for lambs fed fungal (*T. reesei* and *Rhizopus oligosporus*) treated roughage (rice straw, bagasse and sawdust) than those fed control. This increment of DMI may be due to the increase of the rate of digestion (Gado, 1999 and Shaker *et al.*, 2011) and/or to improve palatability of biologically treated roughage (Belewu and Popoola, 2007 and Soliman *et al.*, 2009).

Feed conversion expressed as kg DM/kg gain tended to be higher for lambs fed biologically treated PTBP than those fed control diet (Table 7). Urea treatment was slightly improved feed conversion compared to control (7.05 vs. 7.18 kg DM/kg gain). The present data are in agreement with those recorded by Fouad *et al.* (1998) and Allam *et al.* (2006 a) who found that feed conversion of animal fed biologically treated roughage showed the most efficient groups followed by those fed chemically treated roughage. Also, Mahrous and Khorshed (2012) reported that fungal treated rice straw groups (*P. funiculosus*, *T. reesei* and combination of two fungi) recorded better feed conversion (g DM/g gain) than control group. Feeding of fungus treated diet to ruminant animals improve feed efficiency because of direct incorporation of fatty acids and microbial protein (Meszkiewics *et al.* 2004). Belewu and Popoola (2007) reported that improving feed efficiency of fungal treated sawdust group could be a result of direct improvement in the nutrient content of sawdust.

Table (7): Effect of experimental rations on growth performance and economic efficiency of lambs (120 days).

Item	Experimental rations					± SE
	R1	R2	R3	R4	R5	
Initial live body weight (I.B.W), Kg	18.2	18.4	18.4	18.4	18.2	1.073
Final live body weight (F.B.W), Kg	31.8 ^b	36.4 ^a	37.8 ^a	38.6 ^a	34.6 ^{ab}	1.452
Total body gain, Kg	13.6 ^c	18.0 ^{ab}	19.4 ^{ab}	20.2 ^a	16.4 ^{bc}	1.171
Daily gain, g	115 ^c	150 ^{ab}	162 ^{ab}	168 ^a	137 ^{bc}	9.708
Intake:						
Concentrate (DMI), g	751	773	817	844	774	
PGTB (DMI), g	175	198	215	224	189	
Total DMI, g	826	971	1032	1068	963	
Feed conversion (DMI Kg/Kg gain)	7.18	6.47	6.38	6.34	7.05	
Economic Efficiency						
Price of daily gain, LE	4.03	5.25	5.66	5.89	4.78	
Concentrate feed mixture, LE	1.802	1.855	1.961	2.026	1.857	
Pruning grape trees by-product, LE	0.044	0.050	0.054	0.056	0.047	
Daily feed cost, LE	1.846	1.905	2.015	2.082	1.904	
Feed cost/kg gain, LE	16.05	12.70	12.46	13.37	13.94	
Daily profit, LE	2.18	3.35	3.64	3.81	2.89	
Relative feed cost, %*	100	79.10	77.62	77.03	86.82	
Relative daily profit, %**	100	154	167	175	132	

^{a,b} and ^c Means in the same row with different superscript letters are significantly (P<0.05) different.

Price of 1 ton CFM= 2400 LE Price of 1 ton un-treated grape pruning tree by product = 250 LE. Price of 1 ton treated pruning grape trees by-product = 295 LE. Market price of 1 kg live body weight in (2014) = 35 LE. *Relative feed cost, %=Feed cost, LE/kg gain (R2, R3, R4 or R5)/R1. **Relative daily profit, % =Daily profit LE (R2, R3, R4 or R5)/R1.

Regarding to economic efficiency, results showed that R4 had the lowest relative cost (%) and feed cost LE/kg gain followed by R3, R2 and R5 compared with control. Daily profit, LE and relative profit, (%) were improved by feeding rations contained treated PTBP and the best values were observed with R4 followed by R3, R2 and R5 in comparison with the control one (R1). These results are in agreement with Deraz (1996) and Ibrahim (2001) who reported that chemical and biological treatments of rice straw and corn stalks decreased the cost of feeds used to produce 1 kg of live body weight gain. Also, Soliman *et al.* (2009) and Abdel-Azeem *et al.* (2011) recorded that feed cost per kg gain and economic efficiency were better with animals (calves and sheep) fed rations containing fungal (*T. hariznoum* and *T. viride*) treated roughage (corn stalks and straws of wheat, rice, bean and clover) than untreated ration.

CONCLUSION

It could be concluded that incorporation of Fungus treatment of pruning peach trees by-products in lambs rations improves digestibility, nutritive value and increasing the performance of growing lambs meanwhile, solving the problem of environmental pollution and treatment with a combined of the two fungi (R4) showed the best results.

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الأداء الانتاجي للمجترات الصغيرة المغذاة على مخلفات تقليم اشجار الفاكهة : ٢-
تأثير مخلفات تقليم أشجار الخوخ المعاملة على نمو الأغنام
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تهدف هذه الدراسة الى تقييم المعاملة الكيماوية والبيولوجية لمخلفات تقليم اشجار الخوخ على التركيب الكيماوى ومعاملات الهضم والقيمة الغذائية وتأثير التغذية عليها على الاداء الانتاجي للحملان الاوسيمى حيث استخدم ٣٠ حمل بمتوسط وزن ١٨ ± ٠.٢. عمرها ٤ اشهر تم توزيعها عشوائيا الى خمسة مجاميع (٦ حملان /مجموعة). غذيت الاغنام على عليقة مكونة من علف مركز و مخلف تقليم اشجار الخوخ لمدة ١٢٠ يوم وكانت العلائق كالتالى:

- ١- مخلفات تقليم اشجار الخوخ غير معاملة (مجموعة المقارنة).
 - ٢- مخلفات تقليم اشجار الخوخ المعاملة بفطر *T. reesei*
 - ٣- مخلفات تقليم اشجار الخوخ المعاملة بفطر *T. viride*
 - ٤- مخلفات تقليم اشجار الخوخ المعاملة بالفطرين *T. reesei + T. viride*
 - ٥- مخلفات تقليم اشجار الخوخ المعاملة باليوربا ٣(%)
- تم اجراء تجربة *in situ* لتقدير معدل اختفاء كل من المادة الجافة والمادة العضوية والبروتين الخام فى الكرش وقد اوضحت النتائج زيادة معدل اختفاء كل من المادة الجافة والعضوية والبروتين الخام للمخلفات المعاملة سواء باليوربا او بالفطر وسجلت المعاملة الرابعة والمحتوية على الفطرين معا افضل النتائج تم اجراء تجربة هضم باستخدام ١٥ كبش تام النمو (٣ فى كل مجموعة) لتقدير معاملات الهضم والقيمة الغذائية فى صورة مركبات كلية مهضومة وبروتين خام مهضوم كما تم جمع عينات سائل الكرش والدم فى نهاية فترة الجمع وقد اشارت النتائج الى تحسن قيم كل من معاملات الهضم والمركبات الكلية المهضومة و معدل النمو اليومي وكذلك الوزن النهائى كما اظهرت النتائج تحسن كل من معدل التحويل والكفاءة الاقتصادية للعلائق المحتوية على مخلفات تقليم اشجار الخوخ سواء المعاملة باليوربا او الفطروكانت النتائج افضل مع المعاملات بالفطر وخصوصا بالنسبة للمجموعة المغذاة على المعاملة الرابعة (الفطرين معا) وبصفة عامة فان المعاملات البيولوجية ادت الى زيادة معاملات هضم مكونات الالياف.
- اشارت قياسات الكرش الى زيادة تركيز كل من الامونيا والاحماض الدهنية الطيارة الكلية بينما لم تكن هناك فروق معنوية بين المجاميع بالنسبة لدرجة الحموضة (pH) نتيجة التغذية على المخلفات المعاملة بالفطر او اليوربا كما لم تتأثر مكونات الدم (البروتين الكلى- الالبيومين- الجلوبيولين- اليوربا- GPT - GOT). وكانت افضل النتائج مع المجموعة الرابعة من حيث القيم الغذائية (مركبات كلية مهضومة؛ بروتين خام مهضوم) وكذلك الزيادة الوزنية ومعدل النمو يومي هذا بالاضافة الى تحسن كفاءة التحويل.
- يستنتج من النتائج السابقة ان استخدام مخلفات تقليم اشجار الخوخ المعاملة خاصة بالفطر فى علائق الاغنام الاوسيمى ادت الى تحسن معاملات الهضم والقيمة الغذائية هذا بالاضافة الى تحسن معدل النمو اليومي وكفاءة تحويل الغذاء والكفاءة الاقتصادية وكانت افضل النتائج مع استخدام المخلفات المعاملة ببيولوجيا بالفطرين معا.