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EVALUATING THE POSSIBILITY OF RECYCLING BANANA WASTE AS A FEED FOR RUMINANTS:
II- GROWTH PERFORMANCE, BLOOD PICTURE, AND FEEDING ECONOMICS BY LAMBS

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ABSTRACT

Three undergroind trenches with the capacity of 6 tons (2 tons each) were used for making silage from banana wastes. Rice straw was added to banana wastes at the rate of 1:2, while molasses was added at the rate of 5%. The first silage (T_2) was made without any additive. In the second silage (T_3), urea was added at the rate of 3%, while in the third silage (T_4), EM_1 (biological treatment) was added at the rate of 1%. Whereas T_1 was a control. The rations were *ad libitum* of silage, while concentrate feed mixture consisted 70% from the requirements. Twenty lambs (cross breed Finnish rams, Finnish x Rahmani) having 4 months of age and averaging 22 $\pm$ 0.5 Kg live body weight were used in this experiment. Lambs were divided into four similar groups according to their live body weight (5 animals in each). The results indicated significant ($P < 0.05$) differences in daily bodyweight gain between (T_2 and T_4) and (T_1 and T_2), being (111.94 and 145.37) and (164.72 and 111.94 g/h/d), respectively; yet, insignificant ($P > 0.05$) differences were found between (T_3 and T_4) and (T_2 and T_3), being (131.11 and 145.37) and (111.94 and 131.11 g/h/d), respectively. The T_4 showed more feed intake compared to T_3 and T_2, being 189.45, 183.87 and 174.29 kg, respectively, and significant ($P < 0.05$) differences were found between (T_2 and T_4) and (T_1 and T_2), being (174.29 and 189.45) and 199.94 and 174.29 kg), respectively, but insignificant ($P < 0.05$) differences were found between (T_2 and T_3) and (T_3 and T_4), being (174.29 and 183.87) and (183.87 and 189.45 kg), respectively. Concerning feed conversion, there were no significant differences among T_1, T_3 and T_4 and among T_2, T_3 and T_4, being 6.8, 7.87 & 7.33 and 8.78, 7.87 & 7.33, respectively, but significant difference ($P < 0.05$) was found between T_1 and T_2, being 6.8 and 8.78, respectively. Blood analysis showed no significant differences among treatments in red blood corpuscles count; yet, there were significant differences in hemoglobin, hematocrit value (%), and white blood cells count among treatments. Moreover, no significant differences were recorded among treatments in globulin, A/G ration, AST, ALT urea nitrogen and creatinine. But significant differences ($P < 0.05$) were given among treatments in total protein, albumin and Alk-P-ase. Economic evaluation reflected significant differences ($P < 0.05$) between T_1 and T_2 (216 and 201%), T_1 and T_4 (216 and 239%), T_2 and T_3 (201 and 222%) and T_3 and T_4 (222 and 239%). From the foregoing results it could be concluded that EM_1 as an additive for making silage of banana waste was effective and costly from the view point of economy, even concerning feed conversion which was statistically similar to the control. So, it to recommend using banana waste silage with EM_1 (or urea) in feeding ruminants without any harm effects on growth performance, feed utilization and animal health, but to overcome, to some extent, the gap in animal feed stuffs by introducing banana waste silage as a novel feed resource in the economical animal production.

Keywords: Banana waste – Lambs – Performance – Blood – Economics.

INTRODUCTION

In Egypt, animal feed resources are limited which do not allow increasing livestock population to a level satisfies human demands. Moreover, feed shortage is also unevenly divided between summer and winter. Encouraging results obtained confirm that using crops wastes in animal diets could participate in reducing the shortages of animal feeds and subsequently increase milk and meat production. Many efforts have been done to evaluate available waste products for feeding animals (Abdelhamid, 1988). Banana leaves and pseudo stems have chemical analysis close to clover composition and can play an important role to cover some nutrient requirements of the animals (Abd El-Gawad *et al*., 1994). Highest live weight gain was achieved when diet was supplemented with banana, this suggests that fodder supplement with green banana can improve cattle nutrition in the humid tropics (Ibrahim *et al*., 2000). Wastes of banana trees are one of the solutions may share in solving this problem. Biological treatments (El-Ashry *et al*., 2003 and Abdelhamid *et al*., 2006, 2007, 2009a, b and c) were used to improve the nutritive value and digestibility of poor quality roughages. Increasing the digestibility of the diet by using exogenous enzymes will lead to the beneficial effects on animal performance, so such treatments are likely to be greatest for ruminants in negative energy balance, such as animals in early lactation (Rode *et al*., 1999). The main objective of this study was to determine the influence of incorporation of different kinds of silage made from banana plant wastes on growth performance, feed intake and conversion and same blood parameters besides economic efficiency by ram lambs.

MATERIALS AND METHODS

This work was carried out at Sakha Animal Production Station, Animal Production Research Institute, Agric. Research Center and Animal Production Department, Faculty of Agriculture, Al-Mansourah University during 2007/2008 for about 26 weeks. Silage preparation, diets and animals used herein are the same mentioned in the 1^{st} part of this series (Abdelhamid *et al*., 2009d). So, to study the effect of feeding lambs on three different types of silage on growth performance, twenty crossbred ram lambs (3/8 Finnish Landrace x 5/8 Rahmani) having 4-5 months of age and averaging 22 $\pm$ 0.5 Kg live body weight were used in this experiment. Lambs were divided into four similar groups according to their live body weight (5 animals in each). Lambs in all groups were fed diets which contained the same amount of concentrate feed mixture (CFM). The dietary treatments were T1) concentrate feed mixture (CFM) of lactation (17% CP) + berseem hay (BH) as a control; T2) CFM + banana waste silage (BWS) without additives (banana waste 2:1 rice straw + 5% molasses); T3) CFM + BWS with urea 3% + 5% molasses (BWUS); and T4) CFM + BWS with effective microorganisms 1% (EM_1 + 5% molasses, BWES). Feeding of all groups was on the basis of 4% DM of their live body weight, concentrate ratio in diet of all groups was 70% from NRC (1985) requirement silage *ad libitium*. Amount of CFM were adjusted biweekly according to the actual live body weight. The experimental feeding period lasted from weaning up to 180 days. Freshwater and Calphos Block (from Turkey) were available all times and feeds were offered twice daily at 8 a.m and 4 p.m.

Throughout the feeding period of lambs, all animals were biweekly weighed and average daily gain was calculated. At the end of each digestibility trial, blood samples were collected from each animal at early morning before feeding from the jugular vein of each animal at 8 a.m into vacationer tubes. Hematological parameters: including count of red blood cells (RBC's) and white blood cells (WBC's), packed cell volume (PCV%), and hemoglobin concentration were determined in fresh whole blood using fully digital hematology counter (Laboratories, USA). Other collected samples were allowed to clot and centrifuged at 3500 rpm for 20 minutes to separate blood serum. Serum was carefully decanted into labeled tubes using serological pipettes and stored at -20ºC until analysis. Total protein and albumin concentrations were determined using commercial kits according to the Douman *et al*. (1971). Globulin was calculated by difference. Albumin/globulin ratio was calculated. Activities of serum transaminases AST and ALT were determined according to Reitman and Frankel (1957), whereas serum activity of alkaline phosphatase was determined by the method of King and King (1959). Blood serum was tested for urea nitrogen concentration according to Talke and Schubert (1965) and for creatinine by the method of Joffe reaction described by Giorgio (1974). All biochemical parameters were estimated using colorimetric methods via commercial kits purchased from bio-Merieux, Laboratory Reogents and Products, France.

Economical efficiency was determined according to price of 1 ton of concentrate feed mixture (FCM) = 1500 LE, price of 1 ton of berseem hay = 700 LE, price of 1 ton of banana waste silage = 110 LE, silage with urea = 130 LE, price of 1 ton of Banana waste silage with EM_1 = 110 LE, market price of 1 Kg live body weight year 2008 = 18 LE, total feed cost = intake of different feed stuffs x their prices, feed cost/Kg gain = total feed cost/total weight gain, output of total weight gain = total weight gain x price of 1 Kg live body weight, and economic efficiency = (output of total weight gain/total feed cost) X 100.

Statistical analysis:

The obtained data were statistically analyzed using general linear models procedure adapted by SPSS (2004) for Windows for user's guide. Least significant differed according to Duncan (1955) within program SPSS was done to determine the degree of significance between means.

RESULTS AND DISCUSSION

Growth performance:

Body weight and gain:

Results in Table (1) show that lambs in the control group (**T_1**) showed the highest significantly ($P \leq 0.05$) final weight and total and daily gain as compared to those fed banana waste in fresh (T_2), silage with urea

(T_3) or silage with EM1 (T_4). In comparing different banana waste groups, lambs in T_4 (fed banana waste with EM1) showed the highest growth performance parameters, being significantly ($P \leq 0.05$) higher than those in T_2 (fresh banana waste), but did not differ significantly ($P \geq 0.05$) from those in T_3 (banana waste silage with urea). Viswanathan *et al*. (1989) studied the effect of the nutritive value of banana stalks which replaced 0, 20, 40 and 50% of paragrass. Feeding banana stalks did not have any detrimental effect on the health of the sheep and that although the daily live-weight gains were low, the rate increased up to 40% level of inclusion after which it started to decline. However, Abdelhamid *et al*. (1991a) found that urea treated (ensiled) rice straw reflected non significant ($P > 0.05$) decrease of cows body weight gain. On the other side, Abdelhamid *et al*. (1991b) reported insignificant ($P > 0.05$) higher body weight and daily body gain rate of calves fed urea – supplemented rice straw. Yet, the biological treatment with white rat fungi improved live body weight and growth rate of lambs (Abdelhamid *et al*., 2009c).

Feed and nutrients intake:

It could be seen from Table (1) that total dry matter feed intake averaged 199.94, 174.29, 183.87 and 189.45 Kg for growing lambs fed on T_1 (CFM + BH), T_2 (CFM + BWS), T_3 (CFM + BWUS) and T_4 (CFM + BWES), respectively during the whole period of 26 weeks. These results indicated that the T_4 showed more feed intake compared to T_3 and T_2. There were significant ($P < 0.05$) differences between T_2 & T_4 and T_1 & T_2 (being 174.29 vs. 189.45 and 199.94 vs. 174.29, respectively) and insignificant differences between T_2 & T_3 and T_3 & T_4 (being 174.29 vs. 183.87 and 183.87 vs. 189.45, respectively). Data in Table (1) indicate that the T_4 showed more TDN intake compared to T_3 and T_2, being 123.10, 116.37 and 104.76 Kg, respectively. There was no significant difference ($P > 0.05$) between T_3 and T_4 (116.37 and 123.10 Kg). Yet, there were significant differences ($P < 0.05$) among T_1, T_2, T_3 and T_4 (135.5, 104.76, 116.37 and 123.10 Kg, respectively). Also, the results indicated that the T_4 and T_3 showed more DCP intake compared to T_2 (19.29, 19.23 and 16.59 Kg, respectively). Significant differences ($P < 0.05$) were found between T_2 and each of T_3 and T_4 (16.59, 19.23 and 19.29 Kg, respectively). Also significant differences were found between T_1 and other treatments (22.29, 16.59, 19.23 and 19.29 Kg, respectively). There was no significant difference between T_3 and T_4 (19.23 and 19.29 Kg, respectively. The obtained results agree with those of Gerona *et al*. (1986), who compared the DM intake of cattle and carabao fed solely on leaves, pseudo stem or corm. The carabao generally had a higher DM intake than cattle of both pseudo stem and leaves, but on a live weight basis the DM intake was slightly lower in carabao than in cattle. Viswanathan *et al*. (1989) found that the dry matter intake per Kg $W^{0.75}$ was fairly similar in all treatments. Yet, Geaffroy *et al*. (1978) compared the DM intake of banana leaves and stem with pangola grass by Alpine goats. Dry matter intake (Kg/100 Kg body weight) was 1.36 from banana leaves, 0.66 from stems and 2.26 from pangola grass. Kholif *et al*. (2001) found that dry matter intake slightly ($P > 0.05$) increased with T_2 (*Penicillium funiculusma*) and T_3 (*Saccharomyces cerevi*) compared with control. Hassan *et al*. (2005) found that treatment of banana waste silage resulted in increasing roughage intake, especially with inoculate and EM_1 treatment. Recently, Abdelhamid *et al*. (2007) mentioned that fungal treatment led to low DM intake and feed efficiency by lambs.

Table (1): Growth performance of growing lambs fed the experimental diets (means ± SE).

Item	Experimental treatments			
	T_1	T_2	T_3	T_4
No. of animals	5	5	5	5
Initial body weight (Kg)	22.20 ± 0.73	22.20 ± 0.86	22.20 ± 0.58	22.40 ± 0.68
Final body weight (Kg)	51.85 ± 1.28^{a}	42.35 ± 1.50^{c}	45.85 ± 0.65^{bc}	48.17 ± 1.20^{ab}
Total gain (Kg)	29.65 ± 1.41^{a}	20.15 ± 1.41^{c}	23.60 ± 1.31^{bc}	26.17 ± 2.19^{ab}
Average daily gain (g)	164.94 ± 7.86^{a}	111.94 ± 7.86^{c}	131.11± 7.31^{bc}	145.37±12.14^{ab}
Feed intake and nutritive values on DM basis (Kg):				
Concentrate	133.29	116.19	122.58	126.30
Berseem hay	66.65	-	-	-
Silage	-	58.10	61.29	63.15
Total feed intake	199.94 ± 4.15^{a}	174.29 ± 5.37^{c}	183.87± 1.29^{bc}	189.45 ± 0.90^{ab}
TDN	135.50 ± 2.81^{a}	104.76 ± 3.23^{c}	116.37 ± 0.82^{b}	123.10 ± 0.58^{b}
DCP	22.29 ± 0.46^{a}	16.59 ± 0.51^{c}	19.23 ± 0.13^{b}	19.29 ± 0.09^{b}
Feed conversion ratio:				
DM (Kg)	6.80 ± 0.30^{b}	8.78 ± 0.53^{a}	7.87 ± 0.45^{ab}	7.33 ± 0.55^{ab}
TDN (Kg)	4.61 ± 0.20^{c}	5.28 ± 0.32^{a}	4.98 ± 0.29^{ab}	4.76 ± 0.36^{bc}
DCP (g)	757.71±33.27^{b}	835.54±50.84^{a}	822.80±47.41^{a}	746.38 ± 55.88^{b}

a, b and c: Means with different superscripts in the same row are significantly different at (P < 0.05).

Feed conversion:

It could be seen from Table (1) that the feed conversion (Kg DM/Kg gain) averaged 6.8 T_1, 8.78 T_2, 7.87 T_3 and 7.33 T_4. No significant differences were found among T_1, T_3 and T_4 and among T_2, T_3 and T_4, but there was significant difference between T_1 and T_2 (6.8 and 8.78, respectively). Feed conversion as (Kg TDN/Kg gain) could be seen from Table (1). The results indicated that there were no significant differences between T_1 and T_4 and between T_3 and T_4 (4.61 and 4.76 and 4.98 and 4.76, respectively). But there were significant ($P < 0.05$) differences between T_1 & T_2 and between T_1 & T_3 (4.61 & 5.28 and 4.61 & 4.98, respectively). Data of feed conversion as (g DCP/Kg gain) given in Table (1) show no significant ($P > 0.05$) differences between T_1 & T_4 and T_2 & T_3 (757.71 & 746.38 and 835.54 & 822.80, respectively). But significant ($P < 0.05$) differences were found between T_1 & T_2, T_1 & T_3 and T_2 & T_4 (757.71 & 835.54, 757.71 & 822.80, and 835.54 & 746.38, respectively). It was noticed that T_4 resulted in the best feed conversion, whether as DM, TDN, or DCP/gain comparing with the both other treatments (T_3 and T_2), followed by T_3 and at least T_2. Yet, the control was significantly ($P < 0.05$) equal to T_4. The superiority of feed conversion with T_4 is related to its superiority also in final body weight, total gain, and average daily gain (Table 1), in addition to its superiority in digestibility coefficients of DM, OM, CF, EE, and NFE as well as in the nutritive values (Abdelhamid *et al*., 2009d). This dependent also on its chemical composition (high CP and NFE, and its lower tannins content (Abdelhamid *et al*., 2009d). This is in agreement with Mashour *et al*. (2002), who reviewed the benefits of EM, which excrete analytical enzymes, acids, chelating agents, and antibiotics, so improves chemical composition, digestion and feeding value and consequentially also animal performance. Also, Shoukry *et al*. (1999) recommended to ensile banana wastes as animal feed either with or without urea addition to depress the ill effect of the presence of some anti-nutritional factors such as tannins and alkaloids. However, Kholif *et al*. (2001) found that feed efficiency was insignificantly (P > 0.05) improved with all biological treatments. Moreover, Bendary *et al*. (2006) refer to the improving effect of EM_1 on digestibility, nutritive value and feed conversion. Additionally, Hassan *et al*. (2005) and Mohsen *et al*. (2006) reoffered to the positive effects of biological treatment of banana waste on rumen parameters, degradability, and feeding value.

Blood parameters:

Hematological parameters:

Data of some hematological parameters of the blood collected from animals fed the tested rations are presented in Table (2). There were no significant differences among treatments in red blood corpuscles count, although there were significant differences (P < 0.05) between T_1 and T_2 (10.67 and 8.93), T_2 and T_3 (8.93 and 11.48) and T_2 and T_4 (8.93 and 10.74 g/dl), respectively in hemoglobin concentrations; significant differences (P < 0.05) between T_2 and T_4 (33.33 and 40.00), respectively in hematocrit value (%); and also significant differences (P < 0.05) between T_1 and T_4 (11.17 and 13.07), T_2 and T_4 (10.92 and 13.07), and T_3 and T_4 (11.67 and 13.07), respectively in white blood cells count (x 10^3/mm^3).

Table (2): Mean values ± SE of some hematological parameters recorded in growing lambs fed the experimental diets.

Item	Experimental treatments			
	T_1	T_2	T_3	T_4
Hemoglobin (g/100 g)	10.67 ± 0.22^b	8.93 ± 0.13^b	11.48 ± 0.30^a	10.74 ± 0.66^a
Hematocrit value (%)	37.67± 0.88^{ab}	33.33 ± 2.60^b	38.67± 2.03^{ab}	40.00 ± 1.53^a
Red blood corpuscles (x 10^6/ mm^3)	8.47 ± 0.52^a	8.13 ± 0.12^a	9.53 ± 0.92^a	8.47 ± 0.67^a
White blood cells (x 10^3/ mm^3)	11.17 ± 0.13^b	10.92 ± 0.14^b	11.67 ± 0.47^b	13.07 ± 0.20^a

a, b and c: Means with different superscripts in the same row are significantly different at (P < 0.05).

Biochemical parameters:

Blood profile was completed by estimations of some biochemical parameters in the blood serum for animals fed the tested rations. Their data are presented in Table (3). There were no significant differences among treatment in concentrations of globulin, urea-N and creatinine, albumin/globulin ration, and activity of AST and ALT. Yet, there were significant differences (P < 0.05) among treatments in total protein, albumin, and Alk-P-ase. Total protein significantly differed between (T_1 and T_3) and (T_3 and T_4), being 7.23 and 8.97 and 8.97 and 7.43 g/dl, respectively. Also, albumin significantly differed between (T_1 and T_2), (T_1 and T_3), (T_2 and T_4) and (T_3 and T_4), being (3.97 and 5.13), (3.97 and 5.33), (5.13 and 4.20) and (5.33 and 4.20 g/dl), respectively. Alk-P-ase significantly differed between T_2 80.83 and T_4 30.20 IU/l. Mohamed (2001) showed that banana by-products treated with 4% urea revealed higher values for urea, AST and ALT but less values for globulin and the values for Hb%, total protein and albumin, were nearly similar to the untreated by-products before feeding. He reported also that banana by-products treated with bacteria plus fungi revealed higher values for Hb%, urea, AST and ALT but non significant differences in total protein, albumin and globulin compared to the untreated by-products before feeding. However, 3 hrs after feeding, higher values of total protein, globulin and urea but less values for AST and non significant values for Hb%, albumin and ALT were found compared to untreated banana by-products.

Table (3): Mean values ± SE of some blood serum parameters recorded in growing lambs fed the experimental diets.

Item	Experimental treatments			
	T_1	T_2	T_3	T_4
Total protein (g/dl)	7.23 ± 0.37^b	8.47 ± 0.37^{ab}	8.97 ± 0.44^a	7.43 ± 0.32^b
Albumin (g/dl)	3.97 ± 0.14^b	5.13 ± 0.34^a	5.33 ± 0.23^a	4.20 ± 0.29^b
Globulin (g/dl)	3.27 ± 0.30	3.33 ± 0.62	3.63 ± 0.26	3.23 ± 0.13
A/G ratio	1.23 ± 0.11	1.68 ± 0.40	1.48 ± 0.08	1.30 ± 0.11
Urea nitrogen (mg/dl)	43.20 ± 0.96	43.07 ± 2.24	44.93 ± 4.14	44.67 ± 2.62
Creatinine (mg/dl)	0.43 ± 0.08	0.51 ± 0.05	0.69 ± 0.17	0.61 ± 0.16
AST (IU/l)	24.00 ± 2.08	25.00 ± 1.15	25.00 ± 1.52	24.33 ± 1.76
ALT (IU/l)	10.33 ± 2.40	8.33 ± 1.20	7.00 ± 1.00	7.00 ± 1.15
Alk-P-ase (IU/l)	54.40 ± 18.50^{ab}	80.83 ± 9.16^a	59.80 ± 13.29^{ab}	30.20 ± 4.76^b

a, b and c: Means with different superscripts in the same row are significantly different at (P < 0.05).

Kholif *et al*. (2001) found that yeast treatment (T_3) increased (P < 0.01) serum total protein and albumin, while (T_2, *P. funiculusms*) decreased (P < 0.01) serum AST and cholesterol compared with other treatments. Other blood parameters as globulin A/G ratio, urea, creatinine, ALT, Alk-P-ase, glucose and lipids were not affected by treatments. On the other hand, Hassan *et al*. (2005) found no significant differences among groups concerning all blood constituent. Moreover, Mohsen *et al*. (2006) noticed no significant differences among groups concerning all blood parameters. Generally, the NPN inclusion or fungal treatment were associated with elevated blood contents of Hb, PCV, glucose, total protein and urea of the heifers without any ill symptoms (Abdelhamid *et al*., 1991a&b and 2009b & c). Also, feeding biologically treated roughages to lambs did not cause any abnormal conditions in liver and kidney functions, since all blood parameters reflected nearly similar values with no significant effect of the tested rations (Abdelhamid *et al*., 2007).

Economic evaluation:

The economic evaluation for the experimental diets of (T_1, T_2, T_3 and T_4) is shown in Table (4). The present results showed significant (P < 0.05) differences among treatments in total feed cost, feed cost/Kg gain, out put of total weight gain and economic efficiency. There were significant (P < 0.05) differences in economic efficiency between T_1 and T_2 (216 vs. 201%), T_1 and T_4 (216 vs. 239 %), T_2 and T_3 (201 vs. 221 %) and T_3 and T_4 (221 vs. 239 %), respectively. The best economic efficiency was calculated for T_4 which was even more economic than the control, as well as than the other treatments.

In this results Abd El-Malik *et al*. (2003) and Mohsen *et al*. (2006) recommended that banana by product could be treated biologically (bacteria plus fungi) and chemically (% urea) to minimize the cost of feeding ruminants. Also, El-Sherif *et al*. (2008) found that banana waste can be used with good growth performance and economic efficiency in complete diets alone or plus yeast culture. Recently, Abdelhamid *et al*. (2009 b & c) reported that fungal treatment of agricultural by-products can offer unconventional animal feed which is economical and environmentally friend without any negative effects on animal health.

Table (4): Economic evaluation of the experimental rations fed to growing lambs (means ± SE).

Item	Experimental treatment			
	T_1	T_2	T_3	T_4
Total feed cost, LE	246.59+5.12[a]	180.68+5.57[c]	191.84+1.35[bc]	196.71+ 0.93[b]
Feed cost/Kg gain, LE	8.38+ 0.37[b]	9.10 + 0.55[a]	8.21 + 0.47[b]	7.61 + 0.57[c]
Output of total weight gain, LE	533.70+25.54[a]	362.70+25.46[c]	424.80+23.67[bc]	471.00+39.34[ab]
Economic efficiency,%	216 + 0.09[b]	201 + 0.12[c]	221 + 0.13[b]	239 + 0.19[a]

a, b and c: Means with different superscripts in the same row are significantly different at (P < 0.05).
CFM = 1500 **Berseem hay = 700**
Banana waste silage = 110 **Banana waste silage with urea = 130**
Banana waste silage with EM_1 = 115 [Local price of feed stuffs (LE/ton)].

From the foregoing results it could be concluded that EM_1 as an additive for making silage of banana waste was effective and costly from the view point of economy, even concerning feed conversion which was statistically similar to the control. So, it to recommend using banana waste silage with EM_1 (or urea) in feeding ruminants without any harm effects on growth performance, feed utilization and animal health, but to overcome, to some extent, the gap in animal feed stuffs by introducing banana waste silage as a novel feed resource in the economical animal production.

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تقيـــــيم إمكانيــــــة تــــــدوير مخلفــــــات المــــــوز كعلــــــف للمجتــــــرات. ٢- أداء النمو – صورة الدم – واقتصاديات التغذية للحملان.

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****قسم بحوث استخدام المخلفات – معهد بحوث الإنتاج الحيوانى - مركز البحوث الزراعية**

تم عمل ثلاثة كومات من السيلاج كل كومة مقدارها ٢ طن من مخلفات نبات الموز الكامل، وتم إضافة قش الأرز إلى المخلف بنسبة ١:٢، والمولاس بنسبة ٥% لكل معاملات السيلاج، **السيلاج الأول:** كان بدون إضافات، **السيلاج الثانى:** كان بإضافة اليوريا بنسبة ٣%، **السيلاج الثالث:** كان بإضافة الكائنات الحية الدقيقة EM_1 بنسبة ١%. ولقد استهدفت هذه الدراسة تقدير الأداء للحملان الخليطة بالتغذية على أنواع مختلفة من النبات الكامل لسيلاج الموز مع تقليل تكلفة إنتاج اللحم للحملان. استخدم فى التجربة عشرين حولى خليط عمر ٤ شهور بمتوسط وزن ٢٢ كجم، وقد قسمت الحوالى إلى أربع مجموعات متشابه طبقا للوزن

وذلك لدراسة معدل استهلاك الغذاء من المادة الجافة – معدل النمو اليومى – معدل التحويل الغذائى – والتكلفة الاقتصادية للتغذية على هذه المعاملات. وغُذيت الحوالى فى كل المجموعات على نفس المركزات، وقد قسمت إلى أربع مجموعات تجريبية طبقاً لنوع العلف **المجموعة الأولى** غُذيت على دريس البرسيم وقد اعتبرت كمجموعة مقارنة، **المجموعة الثانية** غُذيت على سيلاج الموز المعامل بالمولاس ٥%، **المجموعة الثالثة** غُذيت على سيلاج الموز المعامل بالمولاس ٥% واليوريا ٣%، بينما **المجموعة الرابعة** فقد غُذيت على سيلاج الموز المعامل بالمولاس ٥% ومعامل ميكروبيولوجيا بـ EM_1 ١%. وغُذيت كل المجموعات على أساس نسبة العلف المركز إلى العلف المائى بنسبة ٧٠% من الاحتياجات الغذائية فى صورة علف مركز والمخلف للشبع – طبقاً للاحتياجات الغذائية **(NRC, 1985)** ويتم التعديل طبقاً للتغير فى وزن الجسم، وقد استمرت فترة التغذية لمدة ستة شهور (١٨٠ يوماً) فى تجربة نمو. ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلى:-

وجدت اختلافات معنوية ما بين السيلاج بدون إضافة والسيلاج المعامل بالكائنات الحية الدقيقة فى معدل النمو اليومى، وكذلك ما بين الكنترول والسيلاج بدون إضافة. توجد اختلافات غير معنوية ما بين السيلاج المعامل باليوريا ٣% والسيلاج المعامل بالكائنات الحية الدقيقة فى معدل النمو اليومى، وكذلك ما بين السيلاج بدون إضافة والسيلاج المعامل باليوريا ٣%. سجل السيلاج المحتوى على الكائنات الحية الدقيقة أعلى قيمة فى كمية المادة الجافة المأكولة مقارنة بالسيلاج المحتوى على اليوريا ٣% والسيلاج بدون إضافة. سجل السيلاج بدون إضافة والسيلاج المحتوى على الكائنات الحية الدقيقة اختلافات معنوية فى كمية المادة الجافة المأكولة، كما سجل السيلاج بدون إضافة والكنترول اختلافات معنوية. لا توجد اختلافات معنوية ما بين السيلاج بدون إضافة والسيلاج بإضافة اليوريا، ولا بين السيلاج باليوريا والسيلاج بالكائنات الحية الدقيقة. سجل السيلاج المعامل بالكائنات الحية الدقيقة أعلى قيمة فى المأكول من المركبات الغذائية المهضومة مقارنة بالسيلاج المعامل باليوريا والسيلاج بدون إضافة، كما توجد اختلافات معنوية ما بين السيلاج المعامل باليوريا والسيلاج المعامل بالكائنات الحية الدقيقة، واختلافات معنوية ما بين الكنترول والسيلاج بدون إضافة، وبين السيلاج المعامل باليوريا والسيلاج بالكائنات الحية الدقيقة. سجل السيلاج المعامل بالكائنات الحية الدقيقة والسيلاج المعامل باليوريا ٣% أعلى قيمة فى المأكول من البروتين المهضوم مقارنة بالسيلاج بدون إضافة، كما توجد اختلافات معنوية بين السيلاج بدون إضافة والسيلاج باليوريا والسيلاج بالكائنات الحية الدقيقة، واختلافات معنوية ما بين الكنترول وباقى المعاملات. لا توجد اختلافات معنوية ما بين الكنترول والسيلاج المعامل باليوريا والسيلاج المعامل بالكائنات الحية الدقيقة، وكذلك ما بين السيلاج بدون إضافة والسيلاج باليوريا والسيلاج بالكائنات الحية الدقيقة، توجد اختلافات معنوية ما بين الكنترول والسيلاج بدون إضافة. لا توجد اختلافات معنوية بين المعاملات فى عدد كرات الدم الحمراء، بينما توجد اختلافات معنوية فى الهيموجلوبين ونسبة الهيماتوكريت وعدد كرات الدم البيضاء ما بين المعاملات. لا توجد اختلافات معنوية ما بين كل المعاملات فى قيم الجلوبيولين، نسبة الألبيومين على الجلوبيولين، ونشاط إنزيمات الكبد (ALT, AST) واليوريا والكرياتينين، بينما توجد اختلافات معنوية ما بين المعاملات فى قيم البروتين الكلى والألبيومين والفوسفاتيز. توجد اختلافات معنوية فى الكفاءة الاقتصادية ما بين الكنترول والسيلاج بدون إضافة، وما بين الكنترول والسيلاج بإضافة الكائنات الحية الدقيقة، والسيلاج بدون إضافة والسيلاج باليوريا، والسيلاج باليوريا والسيلاج بالكائنات الحية الدقيقة. وتوصى الدراسة بكمر أو سيلجة مخلفات نبات الموز الكامل إما بإضافة اليوريا ٣% أو الكائنات الحية الدقيقة (EM_1) والمولاس ٥% والقش والمخلف الموز بنسبة ١:٢ لاستفادة الأغنام من سيلاج هذه المخلفات دون التأثير على الأداء.

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