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Improving Potato Vine Utilization by Sheep Using Biological Treatment

El – Shinnawy, A.M. and M.M.T. Eassawy
Regional Center for Food and Feed,Agric.Res. Center, Giza, Egypt.

ABSTRACT

Twelve mature rams with an average body weight of 65.5±2.8kg were used at Regional Center for Food and Feed Station in four metabolism trials to study the effect of feeding a clover hay or potato vine hay or potato vine silage on nutritive values, rumen parameters, blood picture and economic efficiency. Determination of silage quality and anti - nutritional factors were also studied. Sheep were randomly distributed into 4 equalgroups and housed un seprated cages. The experimental diets were given according to NRC (1990).The feeding was 50% concentrate feed mixture (CFM) and 50% of one the three tested ingredients, clover hay , potato vine hay and potato vine silages. Clover hay was fed in the control group, while the other three tested rations included potato hay or potato vine silage. The results showed that: Solanine values of potato vines hay (PVH) , potato vines silage (PVS) and urea treated potato vines silage (UPVS) were 20.15,8.30 and 7.81 mg / 100g DM ,D respectively. The ensiling process sharply decreased solanine content. The two silages were of excellent quality, and had a normal pH 3.95-4.10 with tendency of superiority of ureated one. The overall means of TVFA's ranged between 7.75-8.15ml eq/100ml R. L., being the higher was recorded for the unureated silage. Potato vines silage (PVS) recorded the least concentration of NH_3 – N(1.72%). The digestibility of OM, NFE and CP of PVH was lower than that of UPVS group, while the highest significant ($p<0.05$) values of TDN (64%), CP(10.70%) and DE(2.98M cal/kg) were recorded with rations containing potato vine silages (PVS and UPVS) in comparison with feeding on clover hay. Also, rams given rations containing silages retained more nitrogen than other groups. Results explained that blood parameters for the group fed PVH were significantly ($P<0.05$) lower (RBC, total protein, albumin, globulin and cholesterol). However, hematocrit, AST, ALT, urea, creatinine and bilirubin values of PVH group were significantly ($P<0.05$) higher compared to PVS, UPVS and control groups. In conclusion, potato vine unureated silage could be used safely, successfully and economically as a good unconventional feed stuffs to raplace clover hay for ruminants, thus minimizing environmental pollution.

Keywords: Solanine residue, potato vine, silage and hay.

INTRODUCTION

Increasing animal protein production in Egypt depend upon the possibility of exploring and utilizing all possible and available resources of agriculture co – products in animal feeding. Potato vine is agriculture one of these waste by-products, which remain after potato harvesting. The annual cultivated area of potato in Egypt is about 390000 feddans (Ministry of Agriculture and Reclaiming Land, 2011), and potato by–products and vine are about five tons / feddan. Therefore, the total waste materials are about 1950000 tons which are estimated to be about 390000 tons of dry matter. Such quantities are usually under exploited or burned in the fields causing environmental pollution. The product consists of 88% vine and 12% discarded potato.

Turning potato by – products into hay is a simple and appropriate method for conversation. Potato vine hay could be used as animal feed ingredient that could be used in feeding animals by the small scale farmers. Such practice of feeding could decrease the feeding cost which is of importance for livestock development in Egypt. The major costs involved in the use of this material in animal feeding is transportation, processing and storage cost since potato vine can be obtained at almost no cost.

Saleh *et al* (2007) found that potato vine hay contains 11.89% crude protein, 56.30% nitrogen free extract and 2.76% ether extract. The primary factors limiting the utilization of potato vine hay is it's low palatability and its solanine content. Patil *et al* (1972) indicated that feeding common potato (*Solanum tuberosum*) led to solanine toxicity and affected performance. Alozie *et al* (1978) found that the amount of solanine was about 0.01 – 0.1% of potatoes dry matter. Morris and Lee (1984) showed that the toxic does is considered to be approximately 2-5mg / Kg live body weight. Thereby, there is a need for more studies on using this by – product in the animal feeding. Saleh *et al* (2007) reported that some process such as biological treatments were found to be most effective in decreasing solanine content and increasing feeding values.

Therfore, the main objectives of this work were:

to study the effect of feeding on clover hay on potato vine hay or potato vine hay or potato vine silages with or without adding urea on nutritive value, some rumen parameters, blood picture, solanine content and economic efficiency.

MATERIALS AND METHODS

The present study was conducted at Regional Center for Food and Feed, Agric. Res. Center, Ministry of Agric., Giza, Egypt.

Potato vine hay:

Whole fresh green potato vines (aerial parts in addition to small infirmity and greenish spots tubers) were obtained from the field (About 25 Km from Giza). The plants were immediately transported to Regional Center, for food and feed. The plants were wilted by spreading in direct sun after being chopped (about 10 cm length). Potato vine hay were shuffled upside – down and mixed well every day until its moisture content regressed to about 12% (complete sun drying). The stock was grinded ground to 3-5 cm length, then packed in plastic bags. Representative samples were taken and kept in tight plastic container for chemical analysis.

Potato vine Silage:

Whole green potato fresh aerial parts in addition to small infirmity and greenish spots tubers were shopped to about 5-8 cm length, then wilted by spreading under direct sun for a day to reach an average moisture content of about 70%. Two silages were made in hard plastic barrels with a capacity of about 120 Kg each. Six barrels were filled with the two tested materials (3 for each treatment).

The two forms of silages were:

1- Untreated potato vine silage (PVS).
2- Potato vine silage supplemented with urea at a level of 1% of the potato vines dry matter and sulphur equivalent to 10% of urea N- used (UPVS).

The content of the barrels were pressed by legs and stocked to trampling to exclude the air content. Finally, each barrel had a tight sealed cover with heavy stones to ensure anaerobic condition. Silage barrels were kept in closed room during the ensiling period which lasted for two months, then the samples were taken to test the physical and fermentative characteristics (Warner, 1964) and chemical analysis according to AOAC (1990).

Metabolism trials:

Four metabolism trials were carried out to determine nutrients digestibility coefficients, feeding values and nitrogen balance of the experimental rations. Twelve mature Rahmany rams with an average live body weight of 65.5 $\pm$ 2.8 Kg were used. The animals were individually housed in metabolic cages. Each trial was carried out with three rams and continued for 31 days of which 21 days were preliminary period following by an experimental period of 10 days through which feces and urine were collected. Composite samples from collected feces and urine of each animal were taken for chemical analysis.

Experimental rations:

Four experimental rations were formulated to cover maintenance requirements of mature sheep according to NRC (1990). Table (1) summarizes the four rations applied in this study.

The concentrate feed mixture (CFM) was offered firstly to animals at 8.0 am, while the different roughages and forages were offered after concentrate consumption. Fresh water as well as minerals and vitamins mixture blocks were available in front of animals in each cage. The chemical analyses of feed ingredients of the experimental rations were as shown Table (2).

Table 1. The experimental rations used the metabolism trials.

Ingredients	Rations (Kg) as fresh			
	R1(Control)	R2(PVH)	R3(PVS)	R4(UPVS)
Concentrate feed mixture (CFM)	0.560	0.560	0.560	0.560
Clover hay (CH)	0.570			
Potato vines hay (PVH)		0.570		
Potato vines silage (PVS)			1.550	
Ureated potato vines silage (UPVS)				1.530

Table 2. Proximate composition of feed ingredients used to formulate the experimental rations.

	CFM*	Clover hay	PVH	PVS	UPVS
DM (%)	**90.15**	**88.60**	**89.30**	**32.50**	**33.15**
Composition of DM, %					
OM	93.90	91.10	90.70	89.41	90.10
CP	14.50	14.55	11.95	13.20	15.10
CF	10.55	28.70	19.20	17.31	17.11
EE	2.85	2.40	2.75	2.65	2.70
NFE	66.00	45.45	56.80	56.25	55.19
Ash	6.10	8.90	9.30	10.59	9.90
Fiber constituents, %					
NDF	35.27	47.35	41.15	44.10	42.60
ADF	23.40	36.20	30.10	29.70	28.10
Hemicellulose	11.87	11.15	11.05	14.40	14.50
Cellulose	14.30	20.71	17.95	18.33	16.49
ADL	9.10	15.49	12.15	11.37	11.61
NFC**	41.28	26.8	34.85	29.46	29.70

CFM* : Concentrate feed mixture consists of 30% yellow corn, 27% wheat bran, 25% undecorticated cotton seed meal , 12 % rice bran, 3% molasses, 2% lime stone and 1% common salt.
NFC: Non – fibrous carbohydrate % = OM% - (CP% + NDF% + EE %) according to Calsamiglia *et al.* (1995).**

Samples of different used feedstuffs, rations, feces and urine – N were analyzed according to AOAC (1990) methods. Fiber fractions as neutral detergent fiber (NDF) was determined according to Van Soest and Marcus (1964), while acid detergent fiber (ADF) and lignin were determined by Robertson and Van Soest procedures (1981). Solanine was determined according to Carman *et al (*1984) and Bushway and R. Ponnampalam (1985).

Rumen liquor samples were taken from each animal in each group at the end of the digestibility trial using a stomach tube at 0,3 and 6 hrs after the morning feeding. The samples were filtered through a double layers of cheesecloth. Ruminal pH was determined immediately using Bechman pH meter, while 1 ml of concentrated HCl was added to rest of the sample to stop microbial activity, filtered through a double layers of cheesecloth and stored in polyethylene bottle in a freezed until analysis. The total volatile fatty acids

(TVFA's) were analyzed according to Warner (1964). The concentration of ammonia – N (NH_3- N) was determined using magnesium oxide as described by the AOAC (1990).

Blood sampling:

Blood samples were collected from all rams at the end of metabolism trial from the jugular vein before morning feeding. Blood samples were then divided to two portions, the first one was for the estimation of red blood cells, white blood cells(Miller and Weller, 1971), hemoglobin and hematocrit (Linne and Ringsrud 1992) and the second one was centrifuged for 20 min. at 3000 rpm and then plasma was separated and stored at – 20 ° C till analysis. Plasma samples were used for determination of total protein (Weichselbaum, 1989), albumin (Doumas *et al*. 1971), globulin (calculated by difference), urea (Patton and Crouch, 1977), liver enzymes (Reitman and Frankle, 1957), total cholesterol (Monnet, 1983), creatinine (Bartiles, 1971) and bilirubin (Monnet 1983).

Economic study:

According to market prices of different feed ingredients used for formulating rations, the feed cost and the price of TDN unit of each experimental ration were calculated. The prices of feed ingredients in Egyptian pounds (LE / ton) were 2400 concentrate feed mixture (CFM), 1700 clover hay (CH), 500 potato vine hay (PVH), 150 potato vine silage (PVS) and 160 ureated potato vine silage (UPVS).

Statistical analysis:

Data were analyzed using the general linear model procedure of SAS (1996). The differences among treatment means were carried out according to Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition of the feed ingredients:

The chemical composition of feed ingredients used for formulating rations are presented in Table (2). The results showed that the chemical composition of concentrate feed mixture (CFM) and clover hay were in agreement with that obtained by El – Shinnawy *et al*. (2011 a&b). The data for the chemical composition of potato vine hay were within the corresponding ranges reported by Saleh *et al*. (2012). The chemical composition of potato vine silage were in agreement with those obtained by Saleh *et al*. (2007).

Crude protein content of ureated silage (UPVS) was noticeably higher than that of the unureated silage (PVS), while OM, CF, EE and NFE content of the two typess of silages were almost similar.

Solanine levels are determined in rations 2, 3 and 4 as well as feces and urine (Table 3). The data indicated that solanine significantly increased ($P<0.05$) in PVH diet, feces and urine of the groups fed potato vine hay (R_2) than those fed rations containing potato vine silages (R3 and R4). The total solanine daily intake of each animal was 100.75, 41.50 and 39.50 mg for PVH, PVS and UPVS, respectively. On the other hand, the feces and urine followed similar trend. The reduction of solanine in silages may have been due to the action of ensiling process and urea supplementation. The results agreed with those obtained by Alozie *et al* (1979). The toxic dose of solanine is considered to be approximately 2-5 mg/ kg live body weight (Chaube and Swinyard, 1976), while the solanine intake of sheep in the present study was less than the toxic dose.

Table 3. Solanine content of PVH, PVS and UPVS rations consumed, feces and urine of Rahmany rams (DM basis).

Items	Solanine consumed (mg / 100g)			Solanine consumed (mg / h/ day)		
	PVH	PVS	UPVS	PVH	PVS	UPVS
Diets	20.15[a]	8.30[b]	7.81 [b]	100.75 [a]	41.50 [b]	39.50 [b]
Feces	6.18 [a]	2.81 [b]	2.95 [b]	30.85 [a]	14.05 [b]	14.75 [b]
Urine	3.87 [a]	1.79 [b]	1.86 [b]	19.33 [a]	8.95 [b]	9.30 [b]
The rest	10.10 [a]	3.70 [b]	3.00[b]	50.57 [a]	18.50 [b]	15.45 [c]

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

Dalvi and Bowie (1983) reported that solanine is a toxic glycoalkaloid, it adversily affects on protein digestibility and growth performance. Swinyard and Chaube (1973) and Chaube and Swinyard (1976) reported that solanine is tratogenical and toxicological phenolic compound.

Silage quality:

The two types of silages were of excellent quality and have a firm texure, yellowish green color and free from molds.

The pH value is the simple test for the prediction of silage quality; it reflects the changes that occur during ensilage (Johnson *et al*., 2002). Many investigators indicated that good quality silage should have a pH value ranging between 3.8 and 4.5 (Ranjhan, 1980; Andrae *et al*., 2001; Ahmed, 2005 and El-Shinnawy *et al*., 2011 a&b). The pH values of the experimental silages used in these trails are presented in Table (4). The results indicated that silage made from UPVS had higher content of ammonia – N than the unureated silage, this could mainly be due to the higher content of NPN which is converted to NH_3- N during fermentation. These results agreed with those reported by Hieu (1969) and El - Shinnawy *et al*. (2011a &b). The results recorded for the silage quality were in agreement with Flynn (1981) and Mc Donald *et al* (1973) who reported that the concentration of NH_3-N as % DM of a good quality silage being usually less than 2.87%. The present results emphasized the relationships between the decreased pH values associated with a decrease in ammonia – N production.

Table 4. Quality characteristics of potato vines silages (% DM) supplemented with or without urea.

Parameters	PVS	UPVS
DM, %	32.50	33.15
CP,%	13.20	15.10
Ash, %	10.59	9.90
pH	3.95	4.10
Lactic acid, % DM	5.95	5.35
Acetic acid, % DM	1.62	1.85
Butyric acid, % DM	0.40	0.44
Total VFA's, % DM	8.15	7.75
NH_3 – N as % DM	1.72	2.31
DM loss, % DM	3.35	3.22

The results indicated that total VFA's for the two treatments ranged between 7.75 – 8.15% being somewhat higher for unureated silage, these results were inagreament with the values obtained by Shaver *et al*. (1985) and Etman *et al*. (1994) with corn silage and El-Shinnawy *et al*. (2011 b) with vine broad bean silage. The high quality silage is characterized by high total VFA's concentration (Langston *et al*., 1985 and El – Shinnawy, 2003). The latic acid concentration of the two types of silages were 5.95 and 5.35% on DM basis of unureated and urea treated vine potato silages, respectively. It is noticed that lactic acid concentration decreased with adding urea to silage during ensiling.

Chemical composition of the experimental rations:

The chemical composition of the four experimental rations which used in the metabolism trials were as shown in Table (5). The results indicated that DM% ranged from 46.90 to 89.70% being higher for R1 and R2 containing clover hay or potato vine hay, respectively. The decreased dry matter content in rations 3 and 4 may have been due to the high moisture content of silage (about 70%).

Table 5. Chemical analysis of the experimental rations.

Items	Rations			
	R1(Control)	R2(PVH)	R3(PVS)	R4(UPVS)
DM,%	89.30	89.70	46.90	47.45
Composition of DM, %				
OM	92.40	92.30	90.50	91.10
CP	14.50	13.45	13.60	15.05
CF	19.45	15.10	13.50	13.40
EE	2.55	2.82	2.70	2.75
NFE	55.90	60.93	60.70	59.90
Ash	7.60	7.70	9.50	8.90
NDF	41.30	38.20	39.65	38.95
ADF	29.80	26.75	26.55	25.75
Hemicellulose	11.5	11.45	13.10	13.20
Cellulose	17.51	16.12	16.33	15.40
ADL	12.29	10.63	10.22	10.35
NFC	34.05	37.83	34.55	34.35

R1= 500g CFM +500g clover hay (CH).
R2= 500g CFM +500g potato vines hay.
R3= 500g CFM +1500g potato vines silage.
R4= 500g CFM +1500g 1% ureated potato vines silage.

There were no pronounced differences in OM, EE, NDF, ADF, hemicellulose and cellulose content among the different rations. As expected, the CP content of the ration enriched with urea (R4) was somewhat higher than that of the unsupplemented ones. Also, the data are clearly indicated that the NFE was increased in silage diets where CF was decreased as in the PVH and control ration. Non fibrous carbohydrate (NFC) ranged from 34.60 – 38.10 in the experimental rations. Calsamiglia *et al* (1995) stated that rations formulated for 35 to 42% NFE (DM basis), should avoid disturbances related to feeding high levels of starche grains. The higher ash content recorded for R3 and R4 compared with R1 & R2 may be related to the relatively high ash content of silages which may be attributed to soil contamination occurred during silage making.

Digestibility coefficients and nutritive values:

Digestibility coefficients and nutritive values of the experimental rations are presented in Table (6). The reduction in digestibility coefficients of OM , NFE and CP of the ration containing potato vine hay (R2) were accompanied with a decrease in the feeding value of this diet expressed as TDN (%) , digestible energy (Mcal / Kg DM) or digestible crude protein (%) than those obtained with silage rations. This reduction in nutrients digestibility and feeding value of R2 may be attributed to the high level of solanine in PVH. This is in agreement with the finding reported by Parfitt *et al*. (1982); Azim *et al*. (1984) and Saleh *et al*. (2007) who reported that solanine affects the digestibility of DM and CP.

Table 6. Nutrient digestibility and feeding values of the experimental rations.

Items	Experimental rations				SE
	R1 (Control)	R2 (PVH)	R3 (PVS)	R4 (UPVS)	
Digestibility coefficient (%)					
DM	67.15^{bc}	66.05^{c}	68.15^{b}	70.10^{a}	± 0.79
OM	65.10^{c}	64.25^{c}	69.33^{b}	71.33^{a}	±0.61
CP	68.30^{b}	67.95^{b}	70.33^{a}	71.10^{a}	± 0.49
CF	45.70^{c}	46.62^{c}	48.15^{b}	50.17^{a}	±0.91
EE	67.55^{b}	68.15^{b}	70.15^{a}	71.10^{a}	±0.82
NFE	70.12^{b}	69.33^{b}	72.75^{a}	72.10^{a}	±0.73
NDF	66.75^{b}	65.75^{b}	68.15^{a}	69.16^{a}	±0.10
ADF	63.15^{a}	63.85^{a}	61.33^{c}	62.10^{b}	±0.89
Hemicellulose	76.10^{b}	70.22^{c}	81.90^{a}	83.04^{a}	±1.12
Cellulose	65.20^{a}	66.50^{a}	64.10^{b}	65.45^{a}	±0.92
ADL	60.22^{a}	59.81^{ab}	57.10^{c}	58.17^{b}	±0.72
NFC	86.71^{a}	85.45^{b}	86.20^{a}	87.09^{a}	±0.85
Feeding value (%)					
TDN	61.87^{b}	62.74^{b}	63.99^{a}	64.58^{a}	
DCP	9.90^{b}	9.14^{c}	9.57^{b}	10.70^{a}	
TDN:CP (ratio)	6.25	6.87	6.87	6.04	
DE*(Mcal/kg DM)	2.73	2.77	2.82	2.98	
ME**(Mcal / Kg)	2.20	2.23	2.28	2.30	
NE***(Mcal / Kg)	1.40	1.42	1.45	1.46	

a,b and c means within the same row with different superscripts are significantly different at (P<0.05).
DE*(Mcal / kg DM) = TDN % × 0.04409 (NRC, 1985).
ME (Mcal / Kg) = TDN % × 3.56 (Mc Donald *et al*., 1973).**
NE* (Mcal / Kg) = (TDN% × 0.0245) – 0.12 (NRC, 2001).**

The present results showed that the rations containing potato vine silages either with or without urea supplement resulted in higher (P<0.05) digestion coefficients of most nutrients, and NDF and nutritive

values compared with rations containing potato vine hay or clover hay. These results may be attributed to the microbial effects which cause rolubilization of carbohydrate esters of phenolic monomers in the cell wall (Ørskov *et al*, 1983; Rooke *et al*., 1988; Smith *et al*., 1993 and Yan *et al*., 1996). In this respect, Hassan *et al* (2009) indicated that the ensiling process sharply decrease the presence of anti- nutritional material such as solanine which might explain the increased digestibility and feeding values of the types of silages. In generall, ensiling process led to increase nutrients digestibility and feeding values of the diet. However, no significantly differences were obtained in nutrients digestibility and TDN of rations containing clover hay or potato vine hay.

Nitrogen balance (NB):

Results concerning nitrogen intake, excretion and balance recorded for sheep given the experimental rations are presented in Table (7).

The data indicate that animals given R1 and R4 showed significantly (P<0.05) higher nitrogen intake compared with R2 and R3. All animals were in positive nitrogen balance. The highest values of NB were recrded for R3 and R4 (containing potato vine silages), while the lowest values were observed for the group fed R2 but there were no significant difference between R3 and control one. The improvement with rations 3 and 4 were possibly due to the ensiling the process. These results were in agreement with those obtained by Shoukry *et al*. (1999) and El - Shinnawy (2010). Therefore, it is suggested that rams utilize N of the rations containing silages (R4 and R3) more efficiently than ration 2 (containing potato vine hay), respectively. In this respect, Ghanem *et al* (2000) and El – Shinnawy *et al* (2011 a&b) reached similar conclusion with lambs fed silages with concentrate feed mixture.

Table 7. Nitrogen utilization of rams fed the experimental rations.

Items	Rations			
	R1(Control)	R2(PVH)	R3(PVS)	R4(UPVS)
Nitrogen intake (g/h/d)	23.00[a]	21.30[b]	22.22[b]	24.91[a]
Fecal nitrogen (g/h/d)	8.25	6.63	6.42	8.79
Digested N (g/h/d)	15.25	14.67	14.80	16.12
Urinary N (g/h/d)	11.96	11.69	11.15	11.70
Nitrogen retention (g/h/d)	3.29[b]	2.98[c]	3.65[ab]	4.42[a]
% of N- intake (g/h/d)	14.18	13.85	16.77	18.36
% of N – digested (g/h/d)	21.57	20.31	24.66	27.42

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

Rumen parameters:

Data of some rumen parameters are shown in Table (8). The results indicated that the means of rumen pH values were within the normal ranges (5.5 – 7.3) as reported by Hungate (1966) and adequate for cellulolytic bacteria activities. There were insignificant (P< 0.05) differences in rumen pH among the different rations. The pH value decreased after 3 hrs post feeding (6.70) compared with that obtained immediately before feeding (7.24), then it increased significantly again to reach 7.01 after 6 hrs post feeding. The decreasing of pH after feeding might be due to the increasing of TVFA's concentration in rumen liquor (Srivastava *et al*., 1983. El – Deep, 2001. El- Shinnawy, 2003 and El – Shinnawy *et al*. 2011 a&b).

Table 8. Effect of experimental rations on some rumen parameters of rams at different times of sampling.

Items	Time of sampling (hrs)	Experimental rations				mean
		R1(Control)	R2(PVH)	R3(PVS)	R4(UPVS)	
pH	0	7.18	7.33	7.30	7.15	7.24 [a]
	3	6.65	6.71	6.78	6.66	6.70 [c]
	6	7.15	7.01	6.94	6.95	7.01[b]
	mean	6.99	7.02	7.01	6.92	-
NH_3 – N (ml /100 ml R. L.)	0	15.33	14.55	13.11	12.65	13.91 [c]
	3	20.17	18.91	18.33	19.10	19.13 [a]
	6	15.98	14.81	12.95	12.87	14.15 [b]
	mean	17.16[a]	16.09 [b]	14.80 [c]	14.87 [c]	-
TVFA' s (ml eq /100 ml)	0	5.92	6.33	6.91	7.85	6.75 [c]
	3	9.75	9.95	10.33	10.22	10.06 [a]
	6	6.87	6.25	7.15	7.72	7.00 [b]
	mean	7.51[b]	7.51 [b]	8.13 [a]	8.60 [a]	-

a,b and c means within each row or within each column within each trait having similar letter are not significantly different at (P< 0.05).

The ruminal NH_3 – N concentration recorded for rams fed rations at 3 and 4 h containing potato vines silages were significantly (P< 0.05) lower than that observed in the other rations. These results are in agreement with those obtained by El-Shinnawy *et al*. (2011 a and b). Lower ruminal NH_3 – N concentration may give best utilization of ammonia – N by rumen microbes (Saxena *et al*., 1971). Comparing sampling time results indicated that the minimum ruminal NH_3-N concentration was recorded at 0 time, then it increased (P<0.05) to the maximum at 3 hrs post feeding then tended to decrease (P<0.05) again at 6 hrs

post feeding. Almost similar results were obtained by Ahmed (1995); Abdo Azzam (2002); El- Shinnawy (2003) ; Gabr *et al* (2010) and El- Shinnawy *et al* (2011 a&b).

The results showed that the overall means of TVFA's concentrations were significantly (P< 0.05) higher for rams fed rations 3 and 4 than other groups, while there was no significant difference between the two groups fed rations 1 and 2 . These results are in agreement with those obtained by Mohamed *et al* (2000), El- Shinnawy (2010) and El- Shinnawy *et al*. (2011 a & b) who found that TVFA's concentrate increased with silage feeding. The pattern of TVFA's values followed the reverse trend of the obtained NH_3 – N values.

Blood parameters:

The results of the blood parameters are illustrated in Table (8). Data indicated that group fed on PVH had significantly (P< 0.05) decreased RBC, total protein, albumin, globulin and cholesterol/ but significantly (P<0.05) increased hematocrit, liver enzymes (AST, ALT), urea, creatinine and bilirubin compared with PVS, UPVS and control groups. At the same time, there were no variations between rations containing potato vines silages and control groups. These results were in accordance with those obtained with Dalvi (1985) and Saleh *et al*. (2007& 2012).

In general, all obtained blood parameters values were within the normal range. Rakha (1988) reported that the normal levels of serum urea- N in sheep range from 8 to 40 mg / dl. While, the normal plasma creatinine level is ranged between 1.2 and 1.9mg/ dl in sheep blood (Kaneko, 1989). The values for AST and ALT reported by Abd El- Kareem (1990) ranged from 24 to 65 and from 14 to 37 U/L for AST and ALT, respectively. The present estimates of total protein was close to the value (6-9 g / dl) reported by Smith *et al* (1974) and (6-8 mg / dl) reported by Recce (1991).

Table 9. Effect of experimental rations on some blood parameters of Rahmany rams.

Items	Experimental rations			
	R1(Control)	R2(PVH)	R3(PVS)	R4(UPVS)
RBC ($x10^6$ /UL)	10.34[a]	8.33[b]	10.21[a]	10.39 [a]
WBC ($x10^3$/UL)	7.61 [a]	6.98 [a]	7.71 [a]	7.59 [a]
Heamoglobin (g/dl)	9.42 [a]	8.12 [b]	9.39 [a]	9.13 [a]
Hematocrit (%)	22.15 [b]	33.11 [a]	21.81 [b]	23.15 [b]
Total protein (g/100 ml)	8.75 [a]	7.10 [b]	8.69 [a]	8.81 [a]
Albumin (g/100 ml)	4.95 [a]	3.41 [b]	4.86 [a]	4.79 [a]
Globulin (g/100 ml)	3.71 [a]	2.95 [b]	3.69 [a]	3.69 [a]
AST (U/ ml)	37.25 [b]	55.10 [a]	39.15 [b]	36.15 [b]
ALT (U / ml)	32.31 [b]	37.20 [a]	30.61 [b]	30.81 [b]
T.cholesterol (mg /100 ml)	81.15 [a]	55.10 [b]	78.11 [a]	79.81 [a]
Urea (mg /100 ml)	20.13 [b]	27.95 [a]	19.33 [b]	20.31 [b]
Creatinine (mg / 100 ml)	1.26 [b]	1.85 [a]	0.95 [b]	0.89 [b]
Bilirubin (mg / 100 ml)	0.36[c]	0.92 [a]	0.68 [b]	0.71 [b]

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

Economic study:

The feed cost and the price of TDN unit of each experimental ration are presented in Table (10). The results indicated that the highest cost was recorded for the control ration (clover hay ration), while the lowest cost was recorded for R3. (potato vine silage ration, PVS). The other two rations had intermediate and nearly similar values. So, the highest price of TDN unit was noticed with R1followed by rations 2, rations 3 and 4 were similar and had lowest values.

The use of all potato vines rations decreased the price of TDN unit compared with clover hay ration (R1). The highest % of decreasing price of TDN unit was recorded for rations 3 and 4 which had similar % of decreasing in prices followed by R2.

Table 10. Feed cost and prices of TDN unit of the experimental rations.

Items	Experimental rations			
	R1(Control)	R2(PVH)	R3(PVS)	R4(UPVS)
Feed cost (P.T.)	205	145	143	143.9
TDN, %	61.87	62.74	63.99	64.58
Price of TDN unit (P.T.)	3.31	2.31	2.23	2.23
% of decreasing price of TDN unit than that of control	-	30.42	32.83	32.83

Including 5 P.T. as a cost of vitamins and minerals mixture for animal / day.

CONCLUSION

In conclusion, potato vine treated with urea or unureated silages could successfully be used safely, and to replace clover hay in ration of rams at 50%, with viable economic value of return.

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تحسين إستفادة الأغنام من عروش البطاطس فى علائق الأغنام بإستخدام المعاملات البيولوجية

أحمد محمد الشناوى وممدوح محمد طاهر عيسوى

المركز الإقليمى للأغذية والأعلاف- مركز البحوث الزراعية – جيزة – مصر

تم تصميم هذا البحث لدراسة إمكانية الإستفادة من عرش البطاطس كمصدر علف جديد فى تغذية المجترات وكذا محاولة تحسين قيمته الغذائية لتصنيعه فى صورة دريس أو بالسيلجة سواء بتدعيمه باليوريا أو عدم تدعيمه. ولقد أجريت التجربة بمحطة تجارب المركز الإقليمى للأغذية والأعلاف بإستخدام إثنى عشر كبشاً بمتوسط وزن ٦٥ كجم فى أربع تجارب تمثيل غذائى لمقارنة التغذية على دريس عرش البطاطس أو سيلاجة أو دريس البرسيم فى علائق الأغنام النامية على القيم الغذائية، قياسات سائل الكرش، صورة الدم والكفاءة الإقتصادية كما تم أيضاً دراسة نوعية السيلاج والمواد المثبطة للتغذية.وتم تغذية الحيوانات طبقاً لمقررات الـ NRC(١٩٩٠) واشتملت جميع العلائق على ٥٠% مخلوط علف مركز وتم تغطية عليقة المقارنة بـ ٥٠% دريس برسيم. أما المعاملات الثلاث فقد تم تغطية الاحتياجات بالتغذية على دريس عرش البطاطس أو سيلاج عرش البطاطس غير مدعم اليوريا أو سيلاج عرش البطاطس مدعم باليوريا ولقد أظهرت النتائج ما يلى :كانت قيم السولانين فى دريس عرش البطاطس، سيلاج عرش البطاطس وسيلاج عرش البطاطس المدعم باليوريا هى ٢٠.١٥، ٨.٣٠ و ٧.٨١ ملليجرام / ١٠٠ جرام مادة جافة، على التوالى. و أدت عملية السيلجة إلى إنخفاض حاد فى تواجد السولانين. وكان كلا النوعين من السيلاج ممتازاً وذات درجة حموضة طبيعية (٣.٩٥-٤.١٠) مع تميز السيلا ج المعامل باليوريا وكان المتوسط العام لتركيز الأحماض الدهنية الطيارة يتراوح ما بين ٧.٧٥-٨.١٥ ملللى مكافىء / ١٠٠ مللى سائل كرش وكان مرتفعاً نوعاً ما مع السيلاج بدون إضافة يوريا. وسجل سيلاج عرش البطاطس أقل تركيز لأزوت الأمونيا (١.٧٢%).كما أظهرت النتائج إنخفاض معاملات هضم المادة العضوية، المستخلص خالى الآزوت والبروتين الخام لعليقة دريس عرش البطاطس عن علائق سيلاج عرش البطاطس، بينما وجد إرتفاع معنوى فى قيم المركبات الكلية المهضومة والبروتين الخام والطاقة المهضومة كيلو كالورى / كجم مع العلائق التى تحتوى على سيلاج عرش البطاطس بالمقارنة بالعلائق الأخرى.كما أظهرت النتائج أن الكباش التى تغذت على عليقة بها سيلاج عرش البطاطس كان ميزان الأزوت مرتفعاً عن باقى العلائق.كما أوضحت النتائج إنخفاض مقاييس الدم (كرات الدم الحمراء، البروتين الكلى، الألبيومين، الجلوبيولين والكوليسترول) وكان الإنخفاض معنوى على مستوى ٥% مع العليقة التى تحتوى على دريس عرش البطاطس، بينما زادت زيادة معنوية على مستوى ٥% قيم الـ AST، ALT، اليوريا، الكرياتينين، والبليروبين مع عليقة دريس عرش البطاطس مقارنة بالعلائق الأخرى.وتخلص الدراسة إلى إمكانية إستخدام سيلاج عرش البطاطس بدون إضافة يوريا بأمان ونجاح. فضلاً عن إقتصاديات إستخدامه كمادة علفية جديدة غير تقليدية بدلاً من دريس البرسيم فى علائق المجترات ولتقليص التلوث البيئى

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