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UTILIZATION OF SOME ENSILED AGRICULTURE AND AGRO-INDUSTRIAL BY-PRODUCTS AS ROUGHAGE SOURCES IN RATIONS FOR LACTATING EWE

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ABSTRACT

The effect of utilization of some agriculture by-products as potato tops and agro-industrial by-products as spinach stem and roots in making silage offered to lactating ewes on milk production and composition were investigated. Sixteen multiparous Barki ewe's in the 3[rd] and 4[th] seasons of lactation and of 48.0 $\pm$ 0.46 kg average body weight were randomly divided into four nutritional groups (4 ewes each) and were offered silages made from some agricultural by-products in three groups with one group fed Berseem. In addition, four digestibility trials were conducted on 12 ewes at the end of the lactating trials (three ewes per each group). Concentrate feed mixture (CFM), at 2% live body weight was fed to cover maintenance requirements of lactating ewes. Silage types and Berseem fodder were offered *ad-libitum*.

Results Obtained showed that:

* Ewes fed on different types of silage increased their DMI by about 34.2, 44.7 and 56.6% for potato top silage (R2), spinach stem and roots silage (R3) and spinach stem and roots: potato top silage mixture (1:1) (R4) rations, respectively compared with the control Berseem fodder (R1) ration.
* Daily milk yield of ewes fed on different type of silages increased by about 31, 35 and 22% for R2, R3 and R4, respectively compared with those fed on control ration. However, offered silages increased ($P \leq 0.05$) percentages of milk fat, lactose and gross energy content compared with Berseem fodder. The feed conversion efficiency, on (DM basis) was 6.81, 6.99, 7.33 and 8.76 Kg DMI/kg milk for R1, R2, R3 and R4, respectively.
* Feeding different forms of silage significantly ($P \leq 0.05$) improved almost all nutrients digestibility; DM by about 9.8, 19.1 and 13.9%; OM by 13.7, 18.2 and 15.8%; CP by 15.3, 38.3 and 33.7%; CF by 10.6, 19.1 and 14.8%; EE by 69.0; 40.5 and 43.4%; NFE by 13.2, 15.1 and 13.2% for R2, R3 and R4, respectively compared with the control ration. Higher feeding values of different forms of silage compared with the control ration were obvious.
* Ruminal pH values for all groups at 4 hrs post feeding were decreased. However, ammonia-N and total VFA's concentrations were noticeably increased after 4 hrs of feeding different forms of silage compared with the control ration.
* Total protein, albumin, globulin, creatinine, glucose, GOT and GPT were within the normal range and without significant differences among the different experimental groups.
* Photochemical screening showed that ensiling spinach stem and roots, potato tops or a mixture of both (1:1) depressed the presence of some antinutritional factors such as saponins, glycosides, alkaloids and oxalate.

Accordingly, it could be recommended to use potato tops and spinach stem and roots in making silage to be included in feeding lactating ewes without fearing adverse and economic effects on ewes milk production and its composition.

INTRODUCTION

One of the most important limiting factors for animal production in Egypt is availability of feedstuffs. High quality roughage like berseem, though may be available, is also expensive. There is however, considerable amounts of crop residues such as potato tops and agro-industrial by product as spinach (stem and roots) that can be used as feeds for livestock to get rid of their environmental pollution hazardous effects.

The annual cultivated area from potatoes in Egypt is about 197,251 feddans(Ministry of Agriculture, 2003) and the yield of green tops is about 5.2 tons per feddan. Based on these figures the total annual neglected yield of potatoes green tops is about 1025,705 tons. On the other hand, the annual spinach by-product (stem & roots) produced by one of the agro-industrial by-product companies (Montana) is about 200 tons.

Spinach,containing several active components including flavonoids, exhibit antioxidative, antiproliferative and anti-inflammatory properties in biological system. Spinach extracts have been demonstrated to exert numerous beneficial effects, such as chemo-and central nervous system protection, anticancer and antiaging functions. A powerful, water-soluble, natural antioxidant mixture (NAO), which specifically inhibits the lipoxygenase enzyme, was isolated from spinach leaves. The antioxidative activity of NAO, compared to other known antioxidants and found to be superior in-vitro and in-vivo to that of green tea, N-acetylcysteine (NAC), butylated hydroxytoluene (BHT) and Vitamin E. NAO has been tested for safety and is well tolerated in several species, such as mouse, rat and rabbits. NAO has been found to be nonmutagenic indicating promising anticarcinogenic effects in a few experimental models, such as skin and cancer prostate. It has not shown any target-organ toxicity or side effects, (Liat *et al*., 2003).

Because of their high moisture content, low palatability and perishable nature, the fresh spinach stem & roots and potato tops are difficult to be quickly dried and fermented, the matter which may lead to an environmental contamination. However, no real attempts were done to utilize potato tops in animal feeding. Silage making, must be considered as a processing technique to improve the nutritive value of spinach stem and roots to make them more nutritious. Ensiling, such by-products may offer a valuable reduction in feed costs and minimize the utilization of concentrate mixtures in animal feeding.

The objective of the present study was to investigate the possibility of utilizing potato tops and spinach stem and roots as an unconventional feed resource for lactating ewe rations. Screening of potato tops and spinach stem and roots were also taken in consideration to identify the anti-nutritional components of such materials which might negatively affect on potato tops and spinach stem and roots as feed resources for ruminants.

MATERIALS AND METHODS

The field trials of the present experimental study carried out at the Experimental Farm Station, belong to the Animal Production Department, Faculty of Agriculture, El-Azhar University, while chemical analysis were conducted in the laboratories of Animal Production Department, National Research Center, Dokki, Giza, Egypt to investigate the possible ways for improving the utilization of silage made from potato tops or spinach stem and roots or a mixture made from both of them at the ratio of (1:1) in ewes feeding and its influences on milk production and composition. Photochemical screening was also carried out on the different types of silages to predict and roughly estimate the presence of anti-nutritional components.

1- Collection and processing of potato tops or spinach stem and roots or a mixture from potato tops and spinach stem and roots (1:1) as silage:

Fresh potato tops were collected from (Wardan Villages, 60 km around Giza), while spinach stem and roots were collected from one of the agro-industrial companies (Montana) at Banha, Kalyobia governorate. A mixture made from potato tops and spinach stem and roots at a ratio of 1:1 was also experienced. Fresh plants were chopped (30 cm length) then wilted in the sun for a period of three days, to reach a moisture content of about 65%, the forage appeared green-brownish, in color at the time of ensiling. Plastic sheet was used and placed under the stock to minimize soil contamination.Three different silage mixture forms were prepared by adding only molasses to provide 20% of the dry matter of silage. Sugar cane molasses was dissolved in least amount of water and sprayed with each mixture form. Each silage mixture weighed about 2.0 tons. Three silage forms were ensiled separately in cement pits (2.0 x 2.5 x 2.0m). The mixture was filled in layers stocked by trampling and finally, each silage had a tight sealed, covered with heavy stones to ensure anaerobic conditions. Each silage was supplied with a digged hole at the bottom for seepage collection. Ensiling took place for about 60 days period; by the end of which samples were taken for physical and fermentative characteristics tests.

2- Animals and feeding:

Sixteen pregnant Barki ewes of 3 to 4 years old, weighing on the average 47.8 $\pm$ 0.46 kg at the last four weeks of gestation were used. They were randomly allotted nutritional into four equal and similar groups of four animals each. The experiment lasted one month before lambing and continued for almost three months later. All groups were offered concentrate feed mixture (CFM) at 2% of live body weight to cover animals daily maintenance requirements. The intake of CFM were adjusted biweekly for each group according to the changes occurred in live body weight. The different forms of silage or Berseem fodder (BF) were fed *ad-libitum* (*ad-lib*).

Experimental rations:

1- The control ration consisted of CFM + 2 nd cut Berseem fodder (*Trifolium alexandrium*) (R_1).
2- CFM + potato tops silage (PTs) (R_2).
3- CFM + Spinach stem and roots silage (SSs) (R_3).
4- CFM + potato tops and spinach roots and stem 1:1 silage mixture (SSs:PTs) (R_4).

The CFM was offered to animals once daily at 8.00 a.m. while different forms of silages were offered *ad-lib*. The refused amounts of silages were collected and weighed daily. Samples were taken frequently from the silages and refusals to estimate moisture content. Each group was kept in separate pen under veterinary supervision. Salt blocks and fresh water were freely available throughout the experimental period.

3- Digestibility trial:

Four digestibility trials were conducted on 12 ewes at the end of the lactating experiment (three ewes each). Each digestion trial lasted for 21 days, of which the first two weeks were considered as a preliminary period followed by 7 days collection period to determine the digestibility and nutritive values of the tested rations in response to the tested additives.

4- Recording of milk production and composition:

Offspring were kept with their dams all the time except on the day of milk yield determination.The offspring were separated from their dams at 7p.m.of the day prior to the recording day.

Dams were hand milked (twice/day at 7a.m.and5p.m.)
Representative milk samples (about 10.0%of total milk produced) were taken once weekly from each ewe. From the morning and evening milking of the same day and for 7 consecutive weeks lactation period. Milk pH was directly determined using Orion 680 digital pH meter. Then the samples were composed and analyzed for fat, total solid(TS),solid not fat (SNF),total protein (TP)and ash according to methods of (Ling,1963),white lactose was calculated by the difference.

Milk energy was calculated according to Mc Donald *et al*., (1978) equation. Fat corrected milk was calculated according to the following equation

$FCM = 15 (F \times Y) + 0.4Y$

(FCM = fat corrected milk = 4% fat),

(F = milk fat %) (Y = milk yield)

5- Chemical analysis:

Silage quality assessments:

Samples of each silage mixture were taken, thoroughly mixed and a composite sample was taken to determine silage quality.The fermented material was well pressed and then the filtrate was extracted through four layers of gauze. In the filtrate, pH was directly measured using Orion 680 digital pH meter. Ammonia nitrogen was measured according to Conway and O'Malley (1963) method, while the total volatile fatty acids were measured according to the technique described by Warner (1964).Lactic acid was determined by colourmetric method of Barker and Summerson (1941), and acetic,propionic, isobutyric and butyric acid were measured by HPLC, Kenaur pump 64 U.V. Dector Column. Rezex organic acid acquisition: wave length 210nm flow rate: 0.8 ml/min.

Ruminal liquor parameters:

Rumen liquor samples were collected from experimental animals at the end of each digestibility trial at 4 and 24 hours post feeding using a stomach tube.

The rumen liquor was extracted by filtering the rumen content through four layers of cheese cloth and tested for pH immediately. Ammonia nitrogen concentration was measured according to Conway and O'Malley (1963), while the total volatile fatty acids were measured according to Warner

(1964). Rumen liquor samples were determined after being preserved in polyethylene bottles in a freezer (-20°C) until laboratory analysis.

Blood samples*:* were collected from the jagular vein of 3 ewes from each group, once at the end of the experiment. The samples (5ml/ewe/group) were centrifuged at 4000 rpm for 20 minutes. Part of the separated sera was used for enzymes determination, while the other, was stored frozen at -20°C for further biochemical analysis. Ready prepared kits were used for all colourimetric determinations. Serum total protein was measured by the biuret reaction using Wiener Laboratories (Argentina) Kits according to Armstrong and Carr (1964). Serum creatinine was determined using Wiener Laboratories Kits according to Husdan (1968). Serum glutamic-oxaloacetic transaminase (GOT) and serum glutamic-pyruvic transaminase (GPT) were determined colorimetrically using commercial kits pruchased from Biomericux according to the method of Reitman and Frankel (1957).

The phytochemical screening. was carried out on different forms of silage, as well as potato tops, spinach stem and roots compared with fresh potato tops or fresh spinach stem and roots and berseem for the sake of comparison. This work has been done to predict and roughly estimated the presence of anti-nutritional components as described by Vagel., (1956) for carbohydrates and glycosids (Arthur and Chan, 1962); for saponins (Wall et al., 1954); for tannins and alkaloids (Whillstarlter, 1914); for flavinoids and Schmidt-Nielsen (1964), for (sterols and /or triterpences). Test for oxalate and dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE) and ash of dietary ingredients, faces and feed residues were determined according to A.O.A.C. (1980) procedures. Total digestible nutrients (TDN), starch equivalent (SE) and digestible crude protein (DCP) of the different experimental rations were calculated as mentioned by Abou-Raya (1967).

Statistical analysis:

Data collected were statistically analyzed by one-way analysis of variance according to Steel and Torrie (1980) using the MSTATC procedure. The means were tested for significance using least significant difference test (MSTATC, 1986), at ($P \leq 0.05$).

RESULTS AND DISCUSSION

Proximate chemical composition:

From (Table 1), it was evident that OM contents of BF and PTs were nearly equal and noticeably higher than that of SS: PTs, while SSs showed the lowest OM content. Crude protein contents of SSs and SS: PTs were nearly the same and noticeably higher than that of BF and PTs. Values recorded for CF content showed that SSs, PTs and SS: PTs silages were nearly the same and noticeably lower than that of BF. Values recorded for EE were almost similar for BF, SSs and SS: PTs and were lower than that of PTs. Nitrogen free extract contents of BF and PTs were nearly the same, but higher than that of SS: PTs, while spinach stem, had the lowest NFE content. Therefore, spinach stem and roots silage, potato tops silage and the mixture of spinach stem and roots and potato tops silage point out to a high potential nutritive value of experimental rations.

Chemical composition of consumed experimental rations, showed that the DM content of R_2 and R_4 rations were nearly similar, but higher than that of R_3 ration. However, R_1 showed the lowest DM content due to the higher moisture content of Berseem fodder. Organic matter content of the different experimental rations ranged from 77 to 87%. Rations contained spinach stem and roots or a mixture of spinach stem and roots with potato tops had relatively higher CP content than the other rations, since CP in spinach stem and roots is higher (18.33%). Values recoded for CF and EE were nearly similar for the rations R_1 and R_2 and higher than that of R_3 and R_4rations.

Table (1): Chemical composition of feed ingredients and the experimental rations.

Item	Moister	DM %	Chemical composition (% DM basis)					
			OM	CP	CF	EE	NFE	ash
Ingredients:								
Concentrate feed mixture(CFM)*	-	93.88	90.60	13.04	14.81	3.36	59.39	9.40
Berseem fodder (BF)	90.87	8.79	80.29	12.86	26.75	2.20	38.48	19.71
Spinach stem and roots silage (SSs)	77.07	-	67.19	18.33	19.10	2.20	27.26	32.81
Potato tops silage (PTs)	72.44	-	76.67	11.96	21.56	5.90	37.25	23.33
Spinach stem and roots: Potato tops silage 1:1 (SS: PTs)	67.25	-	72.89	17.43	19.36	2.75	33.35	27.11
Experimental rations: (Calculated value)								
Berseem fodder + CFM (R_1)	72.59	27.41	87.89	12.98	17.93	3.05	53.93	12.11
Potato tops silage + CFM (R_2)	58.34	41.65	83.33	12.47	18.32	4.68	47.86	16.67
Spinach stem and roots silage+ CFM (R_3)	65.19	34.81	77.75	15.93	17.16	2.72	41.94	22.25
Spinach stem and roots: Potato tops silage 1:1 + CFM (R_4)	56.96	43.04	79.39	15.81	17.68	2.97	42.93	20.61

***Concentrate feed mixture consisted of: 23% undecorticated cotton seed meal, 23% yellow corn, 44% wheat bran, 7% cane-molasses, 1.7% lime stone and 1% sodium chloride, 0.30% primex.**

Silage quality:

The three types of silage were free from mold, with suitable fermentation characteristics, yellowish green colour with good smell. The pH values (Table 2) for different silage forms were nearly the same; being 4.3, 4.0 and 4.2 for PTs, SSs and SSs:PTs, respectively. These types of silages were in the normal range of the good quality silages as reported by Mc Donald *etal*.,(1995). It could be noticed that the percentages of total VFA's was negatively correlated with the pH values. These results are in agreement with the findings of Abd El-Malik (1972), who found that the total VFA's in the silage, generally decreased with the rise in pH value. There were also a positive relationship between the pH values and ammonia-N, concentration i.e. the decrease in pH value was accompanied by a decrease in ammonia-N production. The high silage quality is characterized by high levels of lactic acid production. During ensiling, hemicellulose is broken down to pentose sugars which are fermented to lactic and acetic acids as described by Whittenburg *etal*.(1967). The obtained percentage of lactic acid concentration (6.9, 5.56 and 6.3% of DM) (Table 2) was indicated good quality silage as recommended by Chatteriee and Maiti (1981) and Gaafar (2004).

The values obtained for silage quality agreed well with the published reports; that a good silage should have pH 4.0-4.5, lactic acid more than 6%, even 13%, butyric acid less than 1-2% and ammonia-N less than 1% on DM basis or less than 8% as percent of total-N content (Langston *et al*., 1958 and Salle, 1961). In conclusion, ensiling potato tops or spinach stem and roots or a mixture of equal parts of both the two materials with molasses, as easily fermentable materials could be considered proper in formulating ewes rations.

Table (2): Silage quality Assessment.

Parameter	Potato tops silage	Spinachstem and roots silage	Potato tops: spinach stem and roots (1:1) silage
- pH	4.3	4.0	4.2
-Ammonia-N-concentration (mg/100ml silage liquid)	17.5	13.0	15.0
-Total volatile fatty acids concentration (ml equ/100 ml of silage liquid)	16.0	23.0	20.0
- Concentration on DM basis, % of:			
Lactic acid	6.90	5.65	6.30
Acetic acid	1.16	1.60	1.43
Propionic acid	0.72	0.55	0.65
Isobutyric acid	0.10	0.09	0.07
Butyric acid	0.60	0.55	0.63

Dry matter intake and milk yield:

Inclusion of silage in ewe's rations (Table 3) increased total dry matter intake (gm/kg $w^{0.75}$) by about 34.2, 44.7 and 56.5% for R_2, R_3 and R_4, respectively compared to that of the control ration. The improved feed intake with silages might be related to the reduction or reducing in oxalate, saponins, alkaloids and glycosids and improvement occurred in palatability due to ensiling process (Greenhalagh and Reid, 1967 and Moor, *et al*., 1986 and El-Kady *et al*., 1999). The higher milk yield of silage-containing diets may be referred to the higher feeding values of such rations (Table, 5) compared with that of the control one.

Data of FCM and average fat content in ewes milk, indicated in general, the superiority of silage rations groups in both criteria in compare with the control group. However, the insignificant fluctuations recorded among silage groups, may be referred to type of ensiled roughage, in favor of potato tops.

Mohamed *et al*, (1997) found that feeding rations containing corn stover silage increased buffaloes milk yield in comparison with other isocaloric and isonitrogenous rations which did not contain corn stover silage. The present results are in agreement with the observation of Roy *etal*.,(1999) who reported that ewes receiving the early bloom silages consumed more DM (2.07 VS.1.74 kg daily,$P < 0.01$). In conclusion, providing a higher quality silage increased ewes feed intake and milk yield. However, Molina *et al*., (2001) stated that the higher milk yield of Lacaune ewes could not be attributed to the higher DM intake only; other factors such as mobilization of fat reserves, might be required to support this higher milk output.

Results of weekly milk yield (Table 3) showed that, the total milk yield decreased gradually from the fourth week of lactation to reach its minimum value by the 7th week of lactation. Generally, averages of milk yield were, 208, 274, 281 and 254 g/day for R_1, R_2, R_3 and R_4, respectively, indicating significant differences (P<0.05) in favor of R_3 silage ration group. It is of interest to note that inclusion of silage in ewes rations increased average milk yield (g/h/d), average FCM (g/h/d) and average fat (g/h/d) by about 31.7, 34.6 and 21.9%; 38.1, 37.4 and 29.7% and 48.5, 46.0 and 34.2% for R_2, R_3 and R_4 rations, respectively, as compared with the control ration, although differences were not significant between the four experimental rations in this respect. These may be attributed to the high variability among individual ewes within treatments in milk yield and the relatively small number of observations (4 animals/group). This variability might be due to the different genetic ability of the individuals to the biosynthesis of milk.

Table (3): Effect of feeding the formulated silage on productive performance of ewes during 7 weeks of lactation.

Item	Control ration (R1)	Potato Tops silage (R2)	Spinach stem and roots silage (R3)	Potato tops:spinach stem and roots (1:1) silage (R4)
No. of animals	4	4	4	4
Average live body weight (kg)	47.5	48.2	48.5	47.0
Total DM intake (g/h/d)	1377	1880	2037	2155
From CFM	0891	0905	0910	0882
From Berseem	0486	-	-	-
From silage	-	0975	1127	1273
TDMI g/kgw$^{0.75}$	76	102	110	119
TDMI % of L.B.W.	2.9%	3.9%	4.2%	4.5%
Milk yield (g/h/d)				
1st wk	$305.0^{b}\pm17.5$	$433.7^{a}\pm28.6$	$457.5^{a}\pm9.2$	$396.2^{a}\pm21.1$
2nd wk	$277.5^{b}\pm14.9$	$395.0^{a}\pm25.6$	$370.0^{a}\pm7.6$	$337.5^{ab}\pm14.1$
3rd wk	292.5 ± 20.7	377.5 ± 17.9	337.5 ± 12.5	292.5 ± 24.9^{ns}
4th wk	$217.5^{b}\pm20.0$	$310.0^{a}\pm17.1$	$292.5^{ab}\pm20.2$	$237.5^{ab}\pm18.8$
5th wk	142.5 ± 12.5	210.0 ± 18.7	205.0 ± 14.7	185.0 ± 19.1^{ns}
6th wk	120.0 ± 15.9	113.7 ± 17.9	150.0 ± 15.9	136.8 ± 24.8^{ns}
7th wk	107.5 ± 13.2	85.0 ± 8.3	155.0 ± 25.5	198.3 ± 23.4^{ns}
Avg. Milk yield wk.	$1462.5^{b}\pm134.9$	$1924.8^{ab}\pm155.8$	$1967.5^{a}\pm106.2$	$1783.8^{ab}\pm185.2$
Avg. Milk yield (g/h/d)	$208.8^{b}\pm19.26$	$274.9^{ab}\pm22.26$	$281.03^{a}\pm15.18$	$254.7^{ab}\pm26.4$
Avg. FCM* (g/h/d)	$287.7^{b}\pm28.5$	$397.3^{a}\pm33.45$	$395.2^{a}\pm23.72$	$373.15^{ab}\pm38.88$
Fat (g/h/d)	$12.91^{b}\pm2.12$	$19.17^{a}\pm1.64$	$18.85^{ab}\pm1.18$	$17.33^{ab}\pm2.23$
Gross feed efficiency:				
Kg milk/kg TDMI	0.152	0.146	0.138	0.118
KgFCM/kg TDMI	0.21	0.21	0.19	0.17
Feed conversion:				
Kg TDMI/kg milk	6.59	6.86	7.25	8.46

a, and b: Means in the same row having different superscripts are significantly different ($P \leq 0.05$).
***FCM = fat corrected milk (4%) fat.**

But these increases in milk yield may be attributed to the stimulus effect of available nutrients on the mammary gland secretion. Amaar, (1995) found that the average daily Barki ewe milk yield (during season)was 0.28kg.Moreover,Kholif *etal*.,(2001) found that milk production(g/day)and FCM (4%) were 276 and 313g when date seeds and olive cake were included in Barki ewes diets.

In general, the improvement in the milk yield associated with feeding different silages might be due to the decreased protein solubility and degradability in the rumen, consequently more ruminal undegradable protein for digestion and absorption in the small intestine was available, thus increased the availability of amino acids in the small intestine (El-Shabrawy 2000). Control group showed better-feed efficiency (kg milk/kg TDMI) or feed conversion (kg TDMI/kg milk) values compared with silage ration groups. These may be related to the higher DM intake recorded for silage ration groups than that recorded for control group.

Milk composition:

The inclusion of silage in ewes rations significantly ($P \leq 0.05$) increased milk lactose, and milk fat by a about 6.9, 2.8 and 8.8% for R_2, R_3 and R_4 groups, respectively as compared to the control group fed Berseem fodder (Table 4). No significant difference was detected between different groups in pH and total solids. These results are in agreement with those reported by Manfredini *etal*. (1987), who working on 48 Sardinian ewes for 56 days and fed diets of hay and concentrates without or with maize silage and found no difference in milk quality between the two groups. Moreover, Pakulski *et al*., (1999) on 125 Merino ewes found that the use of diets containing maize and sugar beet leaf silage instead of fodder beet had no significant influence on the quality of milk except for protein content.

On the other hand Mahmoud *et al*., (1992) and Elready (2000), found that inclusion of maize silage in the rations of lactating Friesian cows improved average daily actual milk yield. In addition, fat, protein, lactose, solids not fat and total solids of milk were significantly ($P < 0.05$) influenced by the different rations. The increase of milk fat many be due to the improvement in ruminal fermentation particularly crude fiber digestibility (Table 5) producing more acetic acid, which is the main precursor for milk fat synthesis. Overton *et al* (1996) reported that micro organisms might benefit from the increase of ruminal acetate fermentation stimulating synthesis of lipids.

In general, the present results are in agreement with those of El-Ghusien *et al* (2002) with Awassi ewes milk, where the percentage of fat was 6.68, lactose 4.25%, protein 5.59%, ash 1.03% and total solids 18.60%. These results are similar to those reported by Harding (1995) for U.K. breeds, Kostas *et al*. (1995) for Karagouniko breed and Guirgis *et al.*(1980). However, the fat content and total solids are more than those reported by Mahran *et al*. (1990) and Hamed *et al.,* (1993), Kholif *et al* (2001) and Saleh, (2004) for Egyptian breeds. The differences in milk components as reported by various authors, other than species and breeds, may be due to the different conditions affecting milk production such as environmental temperature, availability of feed and water, feed type alongside with age and stage of lactation (Alkanhal, 1993).

Milk gross energy is a good measurement of the milk nutritive value, which reflects the increase in almost milk components particularly, fat percent, which in turn reflects the superiority of diets containing agriculture and agro-industrial by-products in ewe rations.

Digestion coefficients and nutritive values:

Inclusion of silage in the diets, increased roughage dry mater intake in comparison with fresh Berseem(Table5).The higher relative DMI from silages mightbereferred to their lower moisuture content and to the improvement in palatability by ensiling(Moor*etal*,1986, Abd El-Rahman 1996 and El-Kady, 1997). The increased dry matter intake from silage gave positive evidence of the good quality silage.

Table (4): Mean composition of ewes milk as affected by inclusion of silage in their rations.

Composition %	**Control Ration (R1)**	**Potato tops silage (R2)**	**Spinach stem and roots silage (R3)**	**Potato tops: spinach stem and roots (1:1) silage (R4)**
PH	6.61 ± 0.07	6.62 ± 0.04	6.62 ± 0.05	6.62 ± 0.06^{ns}
Total solids	17.63 ± 0.50	17.80 ± 0.32	17.97 ± 0.38	17.80 ± 0.26
Fat	$6.52^{b}\pm0.35$	$6.97^{a}\pm0.29$	$6.70^{b}\pm0.45$	$7.10^{a}\pm0.32$
Solids not fat	$11.11^{a}\pm0.31$	$10.83^{bc}\pm0.36$	$11.17^{ab}\pm0.38$	$10.70^{c}\pm0.22$
Total protein	$5.55^{ab}\pm0.27$	$6.05^{a}\pm0.52$	$5.52^{ab}\pm0.19$	$5.07^{b}\pm0.29$
Ash	$0.94^{ab}\pm0.01$	$0.96^{a}\pm0.09$	$0.94^{ab}\pm0.06$	$0.92^{b}\pm0.09$
Lactose	$4.62^{c}\pm0.13$	$4.73^{a}\pm0.23$	$4.71^{b}\pm0.11$	$4.7^{b}\pm0.17$
GE K cal/kg milk	$1091.1^{b}\pm34.22$	$1135.6^{a}\pm31.49$	$1110.7^{b}\pm22.1$	$1124.4^{ab}\pm19.2$

a,b and c Means in the same row with different superscripts significantly differ ($P\leq0.05$).
ns = no significant difference.

While inclusion of silages in ewes ration led to increase ($P\leq0.05$) almost all nutrients digestibility coefficient values of the diets. The lowest ($P\leq0.05$) digestibility coefficients of DM, OM, CP, EE, CF and NFE were obtained by feeding on Berseem.

These results agreed well with those reported by Shoukry, (1982), El-Talty, *et al*., (1983); Moor *et al*., (1986); Tabana (1994), Abd El-Rahman (1996), El-Kady (1997) and El-Ashry *et al*., (2003), who mentioned that silage making improved its nutrients digestibility and nutritive value which consequently affected milk yield positively.

The higher TDN, SV and DCP intake (g/h/d) was noticed in animals fed R_2,R_3,and R_4 rations containing silages, while R_1ration recorded the lowest ($P < 0.05$) TDN, SV and DCP intake (g/h/d). These results agreed well with those obtained by Kutty and Prasad (1980), Shoukry (1982), Tabana (1994), El-Kady (1997) and El-Shabrawy *et al*. (2004). They mentioned that silage making either with or without urea addition improved nutrients digestibility and nutritive value of forages. However, Tag El-Din *et al.,* (2004) found that the substitution of dried potato tops hay in rabbit diets instead of clover hay at any level (from 5 to 30%) did not affect significantly, live body weight, daily weight gain, daily feed intake, apparent digestibility coefficients and nutritive value. It may be concluded that the ensiling technique, can be safely used for extended storage of agriculture and agro-industrial-by-products and that such silage, can replace conventional roughages as berseem.

Rumen fluid parameters:

The highest values were recorded for pH at (24hrs after feeding) while, the lowest values were recorded 4 hrs post feeding (Table 6). The pH value obtained at all times were within the range, (between 6-7) given by Mertens (1997) and Rakha (1998).

Table (5): Means value of nutrient intakes, nutrients digestibilities and nutritive values of the experimental rations.

Item	Control Ration (R_1)	Potato Tops silage (R_2)	Spinach stem androots silage (R_3)	Potato tops: spinach stem and roots (1:1) silage (R_4)
Drymatter intake (g/h/d)				
Concentrate	938.8	938.8	938.8	938.8
Roughage	$334.07^{d}\pm33.37$	$1022.47^{c}\pm29.44$	$1139.6^{b}\pm6.90$	$1615.6^{a}\pm21.83$
Total	$1272.87^{d}\pm23.73$	$1961.27^{c}\pm29.44$	$2078.4^{b}\pm6.90$	$2554.47^{a}\pm21.83$
Digestibility %				
DM	$59.89^{b}\pm1.49$	$65.76^{a}\pm3.02$	$71.34^{a}\pm2.72$	$68.23^{a}\pm0.79$
OM	$62.75^{b}\pm1.48$	$71.36^{a}\pm2.02$	$74.22^{a}\pm2.04$	$75.71^{a}\pm0.55$
CP	$52.70^{c}\pm1.65$	$60.79^{b}\pm2.52$	$72.91^{a}\pm2.15$	$70.47^{a}\pm3.73$
CF	$53.19^{b}\pm2.22$	$58.83^{ab}\pm3.06$	$63.33^{a}\pm3.15$	$61.0^{ab}\pm2.88$
EE	$48.61^{c}\pm2.79$	$82.19^{a}\pm6.98$	$68.29^{b}\pm3.56$	$69.70^{b}\pm1.57$
NFE	$69.14^{b}\pm2.02$	$78.28^{a}\pm1.81$	$79.56^{a}\pm1.75$	$78.25^{a}\pm0.69$
Nutritive values: (DM basis%)				
TDN	$56.99^{b}\pm1.49$	$64.26^{a}\pm1.62$	$60.03^{ab}\pm1.70$	$60.31^{ab}\pm0.52$
SV	$45.71^{b}\pm1.53$	$51.91^{a}\pm1.59$	$48.76^{ab}\pm1.64$	$48.57^{ab}\pm0.44$
DCP	$6.84^{b}\pm0.22$	$7.43^{b}\pm0.44$	$11.59^{a}\pm0.35$	$11.14^{a}\pm0.11$
Nutrient intake DM basis (g/h/d)				
TDNI	$724.82^{c}\pm9.33$	$1260.9^{b}\pm45.84$	$1247.6^{b}\pm36.21$	$1540.20^{a}\pm12.80$
SVI	$581.17^{c}\pm11.01$	$1018.66^{b}\pm42.03$	$1013.5^{b}\pm34.88$	$1240.4^{a}\pm10.33$
DCPI	$86.95^{b}\pm1.13$	$144.70^{c}\pm10.44$	$240.90^{b}\pm7.53$	$284.5^{a}\pm3.05$

a,b,c and d: Means in the same row having different superscripts significantly differ at ($P\leq0.05$).

These results are in agreement with Cottyn and Boucque (1968). Prasad *etal.* (1972) who indicated that rumen pH is one of the most important factors affecting fermentation rate in the rumen and influences its functions. It varies in a regular manner depending on the nature of the diet and on the time that it is measured after feeding and reflects changes of organic acids quantities in the ingesta. Abd El-Kareem (1990) noticed that the ruminal pH values decreased gradually, reaching the lowest values at 2 hrs after feeding and tended to increase again after 4 and 6 hrs. Tawila (1991) also found that the overall mean of pH in rumen liquor of sheep before morning feeding was 7.1 then decreased to 6.4 at 2 and 4 hrs after feeding.

Total VFA's concentration determined at (24 hours after feeding) and 4 hrs post feeding are shown in Table (6). There was no significant effect of silage feeding on the rumen fluid TVFA's before feeding. In contrast, at 4 hrs post feeding, there was a significant effect when ewes were fed on silage rations in comparison with the control ration. Ruminal TVFA's values, obtained in this study, were within the normal levels (3.07-19.9 m equ/dl of rumen liquor) reported by Kandil *et al*. (1996). Ruminal TVFA's were significantly higher for ewes fed on silage in their rations (R_2, R_3, and R_4) post feeding than control R_1 ration. However, the combination of potato tops and spinach produced the higher ($P< 0.05$) TVFA's in compare with different silage groups.

Moreover, the TVFA's were found to correlate significantly and negatively with ruminal pH values (Muller, 1973). The higher TVFA's values observed in silage-fed groups, R_2, R_3 and R_4 rations at 4 hrs after feeding suggests that, the anaerobic fermentation of silage was more faster and efficiently produced TVFA's more than the control group.

It should be noted that, the TVFA's concentration in rumen is governed by several factors such as DM digestibility, rate of absorption, rumen pH, transportation of the digesta from the rumen to other parts of the digestive tract and the microbial population in the rumen and their activities (Allam *et al*. 1984). One factor or more of these could change its pattern with time and might affect the total concentration of TVFA's found in the rumen media.

Ammonia-N concentrations for the experimental groups were 14.94, 16.40, 19.23 and 17.40 mg/dl rumen liquor (Table 6) before feeding, increased up to 29.52, 27.70, 30.25 and 28.79 mg/dl rumen liquor after 4 hrs of feeding for R1, 2, R3 and R4 rations, respectively, and without significant difference among the different experimental groups. It should be noticed that ammonia-N concentration was increased at 4-hrs post feeding, which might be due to the degradation of crude protein. These results are in agreement with those reported by Mohamed (1998) and Mousa *et al* (1998), who reported that ammonia-N concentration in the rumen liquid was at the minimum level before feeding and increased to maximum level at 3 hrs post feeding.

Table (6): Rumen fermentation parameters at 24 and 4 hrs after feeding ewes, as affected by inclusion of silages in the ration.

Item	Control ration (R_1)	Potato tops silage (R_2)	Spinach stem and roots silage (R_3)	Potato tops: spinach stem and roots (1:1) silage (R_4)
Time	**24 hrs. after feeding**			
PH	7.04±0.07	7.05±0.03	7.11±0.09	7.13±0.03^{ns}
TVFA's m/equ/dl	8.50±0.36	7.60±0.72	8.50±1.02	7.90±0.98^{ns}
NH_3-N, mg/dl	14.94^{b}±0.96	16.40^{b}±1.25	19.23^{a}±0.36	17.49^{b}±1.65
Time	**4hrs. after feeding**			
PH	6.73^{b}±0.03	6.67^{b}±0.07	6.71^{b}±0.09	6.95^{a}±0.05
TVFA's m/equ/dl	9.60^{c}±0.23	13.0^{ab}±1.16	11.50^{b}±0.29	14.30^{a}±0.88
NH_3-N, mg/dl	29.52±0.53	27.70±2.03	30.25±1.58	28.79±0.36^{ns}

a,b and c Means in the same row having different superscripts significantly differ ($P\leq0.05$)
ns = Non significant difference

Blood parameters:

Comparison of blood parameters revealed small fluctuations among groups fed different rations in total protein, albumin, globulin, creatinine, glucose, glutamic pyruvate transaminase (GPT) and glutamic oxaloacetic transaminase (GOT). Meanwhile, globulin concentration was slightly higher with R_3 than other groups. GOT, GPT and creatinine concentration showed some fluctuation among the experimental groups however, the obtained values are within the normal range for healthy ewes.

Generally, the kidneys and liver functions were not adversely affected by potato tops silage or spinach stem and roots and the mixture of both feedstuffs, indicating that the animals were in a good nutritional status. Accordingly, it could be recommended to replace Berseem fodder by such by-products in the form of silage in ewes diets without adverse effects on milk production.

Table (7): Blood parameters of ewes fed on the different experimental rations.

Item	Control Ration (R_1)	Potato tops silage (R_2)	Spinach stem and roots silage (R_3)	Potato tops:spinach stemand roots (1:1) silage (R_4)
Total protein, g/dl	6.08±0.14	6.33±0.12	6.30±0.20	6.32±0.19^{ns}
Albumin, g/dl	3.60±0.20	3.73±0.09	3.43±0.13	3.65±0.14^{ns}
Globulin, g/dl	2.48^{b}±0.12	2.60^{b}±0.05	2.88^{a}±0.03	2.67^{ab}±0.08
Creatinine g/dl	1.11±0.07	1.26±0.09	1.30±0.09	1.18±0.07^{ns}
Glucose, mg/dl	97.9±1.90	99.8±2.1	95.7±3.00	100.1±2.00^{ns}
GOT, u/l	75.5±1.7	88.7±1.6	88.4±3.1	90.9±1.2^{ns}
GPT, u/l	7.93±0.22	8.83±0.59	9.80±0.34	9.90±0.70^{ns}

a and b Means in the same row having different superscripts significantly differ, ($P \leq 0.05$)
ns = no significant difference.

Phytochemical screening of different types of silages compared with Berseem hay:

Generally phytochemical screening showed that ensiling of spinach stem and roots showed slight content of saponin, oxalate and flavonoids compared with fresh materials.Liat *etal* (2003) mentioned that spinach containing several active compounds including flavonoids. On the other hand potato tops silage showed slight content of glycosides, flavonoids and alkoloids compared with fresh materials Mc. Donald *et al.* (1978) mentioned that about half of crude protein content of dry matter of potatoes is in the form non protein nitrogen compounds. One of these compounds is the alkaloid solanidine. Solanidine and its derivatives are toxic to animals causing gastroenteritis. The alkaloid levels may be high in potatoes exposed to light. However, ensiling of potatoes and spinach mixed reduced the presence of such antinutritional materials as alkaloids, saponins and oxalate, or inhibits its activities.

These results may explain the results of feed intake (Table 3 and 5) which showed that the mixture of potatoes and spinach silage inclusion in ewes diet significantly increased ($P < 0.05$) feed intake, in both of feeding and digestibility trials in comparison with Berseem hay.

As a recommendations, further studies are needed to determine the intensity of such antinutritional factors in fresh potato tops, spinach stem and roots and their silage and any other antinutrional factors that might probably be present and was not detected in the present study.

It could be also concluded that inclusion and ensiling of potato tops or spinach stem and roots or a mixture of equal parts of both the two materials with molasses, as easily fermentable material could be considered proper and safety in formulating ewes rations.

Table (8): Phytochemical screening of different forms of silages i.e. fresh silage by-product compared with Berseem hay.

Item	Berseem Hay	Fresh potato tops	Fresh spinach stem and roots	Potato tops silage	Spinach stem and roots silage	Potato and spinach mixed silage 1:1
Sterols	-	-	-	-	-	-
Carbohydrates or glycosids	+	+++	+	++	+	+
Alkaloids	-	++	-	-	-	-
Tannins	-	-	-	-	-	-
Flavonoids	+	++	+++	++	++	++
Saponins	-	-	+++	-	+	+
Oxalate	-	-	+++	-	+	+

+++ intense **++ moderate intense** **+slightly detected** **- non detected**

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الاستفادة من سيلاج بعض المخلفات الزراعية ومخلفات التصنيع الزراعى كمصدر للمواد الخشنة في علائق النعاج الحلابة

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١- قسم الانتاج الحيوانى – المركز القومى للبحوث – دقى – جيزة – مصر
٢- قسم الانتاج الحيوانى – كلية الزراعة – جامعة الأزهر – جيزة – مصر

أجريت هذه الدراسة لبحث الاستفادة من بعض المخلفات الزراعية مثل عروش البطاطس الخضراء وكذلك بعض مخلفات التصنيع الزراعى مثل سيقان وجذور نبات السبانخ فى صورة سيلاج وتأثيرها على إنتاج وتركيب اللبن. استخدمت ستة عشر نعجة برقى حلابة فى الموسم الثالث أو الرابع ومتوسط أوزانها ٤٧,٨ ± ٠,٤٦ كجم من مزرعة محطة التجارب والبحوث الزراعية، التابعة لكلية الزراعة جامعة الأزهر، وقد وزعوا عشوائيا لأربعة مجاميع متساوية، (أربعة بكل مجموعة)، وبعد نهاية موسم الحليب تم استخدام عدد ١٢ نعجة اختيرت عشوائياً ممثلة للمعاملات الأربعة المختلفة فى تنفيذ تجارب هضم لتقييم العلائق المختارة.

تكونت العليقة من العلف المركز بواقع ٢% علف مركز من وزن الجسم للتأكد من تغطية الاحتياجات الحافظة للحيوانات واستكملت التغذية بتقديم السيلاج سواء أكان سيلاج عرش البطاطس (مجموعة ثانية) أو سيلاج سيقان وجذور السبانخ (مجموعة ثالثة) أو الخليط من سيلاج عروش البطاطس + سيقان وجذور السبانخ (مجموعة رابعة) مع المقارنة بالتغذية على البرسيم الأخضر (مجموعة أولى).

- سجلت النعاج المغذاة على أنواع السيلاج المختلفة أعلى معدلات استهلاك يومى للمادة الجافة الكلية. معبرا عنها جم/كجم^{٠,٧٥} بنسب ٣٤,٢ – ٤٤,٧ – ٥٦,٥% للعلائق (٢)، (٣)، (٤) على التوالى بمقارنتها بالعليقة المقارنة (١).
- فيما يختص بإنتاج اللبن اليومى فقد تفوقت مجموعة النعاج المغذاة على السيلاج فى كمية الحليب اليومى حيث زاد إنتاج اللبن اليومى بنسبة ٣١,٦، ٣٥، ٢٢% بالنسبة للعليقة الثانية والثالثة والرابعة على التوالى بالمقارنة بالعليقة المقارنة. أما مكونات اللبن فلم تتأثر معنوياً عند تغذية النعاج على أنواع السيلاج المختلفة، كذلك كانت قياسات كفاءة تحويل الغذاء المقدرة على أساس المادة الجافة للبن هى ٦,٨١، ٦,٩٩، ٧,٣٣، ٨,٧٦ كجم مادة جافة/كجم لبن للعلائق الأولى، الثانية والثالثة ثم الرابعة على التوالى.
- أوضحت النتائج أنه بالتغذية على السيلاج أدت إلى زيادة معنوية فى جميع معاملات الهضم لكل من المادة الجافة (٩,٨-١٩,١-١٣,٩%) – المادة العضوية (١٣,٧-١٨,٢-١٥,٨%) – البروتين الخام (١٥,٣-٣٨,٣-٣٣,٧%) – الألياف الخام (١٠,٦-١٩,١-١٤,٨%) الدهن الخام (٦٩,٠-٤٠,٥-٤٣,٤%) المستخلص الخالى من الأزوت (١٣,٢-١٥,١-١٣,٢%) للعلائق ٢، ٣، ٤ على التوالى بمقارنتها بالعليقة المقارنة. وقد نتج عن ذلك أن سجلت قيم المركبات الكلية المهضومة ومعادل النشا والبروتين الخام المهضوم نتائج أفضل لجميع المعاملات المحتوية على السيلاج مقارنة بالعليقة المقارنة.
- أظهرت تحليلات مكونات سائل الكرش انخفاضاً فى درجة تركيز أيون الايدروجين لجميع المعاملات الغذائية المختلفة بعد التغذية بأربعة ساعات. بينما زاد تركيز الأحماض الدهنية الطيارة بعد التغذية بأربعة ساعات عنه قبل التغذية. أما تركيز أمونيا نيتروجين سائل الكرش فقد زادت زيادة ملحوظة بعد التغذية بأربعة ساعات عنه قبل التغذية لجميع المعاملات الغذائية المختلفة.
- أظهرت تحليلات مكونات الدم (البروتين الكلى، الألبيومين، الجلوبيولين، كرياتينين، جلوكوز، GPT، GOT) عدم وجود فروق معنوية عند التغذية على الأنواع الثلاثة المختلفة للسيلاج بالمقارنة بمجموعة الكنترول. ورغم ذلك كانت القيم جميعها داخل النطاق الفسيولوجى الطبيعى.
- أظهرت الاختبارات الكشفية عن المواد السامة أو الضارة أن سيلاج المخلفات الزراعية مثل سيلاج عروش البطاطس الخضراء وكذلك سيلاج مخلفات التصنيع الزراعى مثل سيقان وجذور السبانخ والخليط منهما أدى إلى انخفاض محتوى تلك المخلفات من بعض المواد الضارة مثل الجليوكوزيدات والصابونين الادكسالات – القلويدات والدليل على ذلك زيادة المادة الجافة المأكولة من السيلاج بالمقارنة بالتغذية على البرسيم.

وتشير هذه الدراسة إلى إمكانية تغطية الاحتياجات الحافظة من العلف المركز للنعاج على أن تستكمل احتياجاتها الغذائية لإنتاج اللبن من الأنواع المختلفة من السيلاج. وبناء على ذلك يمكن التوصية باستخدام مخلفات عرش البطاطس ومخلفات التصنيع الزراعى مثل سيقان وجذور نبات السبانخ على صورة سيلاج أو خليط من تلك المخلفات المسيلجة فى تغذية النعاج الحلابة بدرجة اقتصادية وآمنة أيضاً.