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PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF LACTATING FREISIAN COWS FED RATIONS CONTAINING DIFFERENT LEVELS OF CORN SILAGE

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ABSTRACT

This study aimed to evaluate incorporation of different levels (25, 50 and 75%) of corn silage (CS) as a replacement of concentrate feed mixture (CFM) on chemical composition of tested ration, digestibility coefficients, milk production and milk feed efficiency of lactating Friesian cows. Eighteen animals average 530.6±37.3 kg LBW within 1-5 lactations were randomly divided into three similar groups the 1st group (G1) was fed CFM, CS and berseem hay (BH) at 66: 25: 9 ratio (DM basis), respectively. The 2nd group (G2) was fed CFM, CS and BH at 41 : 50 : 9 ratio, respectively. While the 3rd one (G3) was fed CFM and CS at 25 : 75 ratio.

Chemical analysis and nutritive values as TDN and DCP (66.12 and 6.84%, on DM basis, respectively) of CS indicated that CS could be considered as a good feeding source for ruminant animals. The present results indicated that contents of CP, EE, NFE were the highest (14.2, 3.25 and 58.7%, respectively) in ration (R1) of the control group (G1) as compared to other rations, while R3 of the 3rd group (G3) had the highest CF content (21.5%). Average daily total DM and TDN intakes did not differ significantly among groups. However, DCP intake was significantly ($P<0.05$) lower only in G3 than G1 (1.19 vs. 1.61 kg/h/d). Digestibility coefficients of DM, OM, CP, EE and NFE did not differ significantly ($P<0.05$) higher in R2 (66.97%) and R3 (68.18%) than the control rations (58.5%). R2 and R3 showed significantly ($P<0.05$) higher TDN values (67.54 and 67.62%) than that of R1 (66.61%), while R2 and R3 had significantly lower DCP values (8.97 and 7.82%) than the control rations (10.06%), being significantly ($P<0.05$) higher in R2 than R3.

Average actual milk yield, 4% FCM and adjusted milk yield were significantly ($P<0.05$) higher in cows fed R2 and R3 than those in cows fed the control ration (18.59 and 18.98 ; 18.33 and 18.98 and 4073.7 and 3917.1 vs. 16.49, 15.95 and 3574.8 kg respectively).

Feed conversion and feed efficiency were significantly ($P<0.05$) higher in cows fed R2 and R3 than R1 in terms of total DM, TDN and DCP intake per kg 4% FCM. The differences between cows fed R2 and R3 in feed conversion and milk feed efficiency were not significant for DM and TDN intake, while significant ($P<0.05$) differences were found between R2 and R3 in term of DCP intake/kg milk produced, being higher of cows fed R2 than R3. Economic feed efficiency was markedly higher in cows fed R2 (266.7%) and R3 (328.94%) than the control (205.35%), being higher for R3 than R2 (Table 7). Cows in G2 significantly ($P<0.05$) showed the best reproductive performance in terms of the shortest service period (39.6 d) and days open (88.2 d) and the lowest number of services/ conception (2.3 s/c) Table 8.

Keywords: Friesian cows, corn silage, digestibility, milk production, reproductive measurements.

INTRODUCTION

Feed shortage in summer season in Egypt is more than in winter, where berseem covers most of the nutritional requirements of livestock. With the larger planted area of maize crop in Egypt, silage making from green corn stover and whole corn could share in getting balanced winter feeding, one solution for that gab between winter feeding and summer feeding and decreased feeding cost.

Utilization of maize silage has increased rapidly during the last two decades as forage for dairy cattle in Egypt. The increase can be related to the relatively high energy yield of maize crop in which the whole plant can be ensiled to provide highly palatable source of energy and high quality forage (Mohamed et al., 1999 and Bendary, 2001).

The high energy content along with cheep price of maize silage may promote its use with berseem or berseem hay for feeding ruminants. Incorporation of maize silage along with concentrate feed mixture and berseem hay may correct such dietary disorders accompanied summer feeding. Corn silage is considered as one of the most popular and high quality conserved forages, for the fruitful livestock production in most regions overall the world. No Egyptian data on reproductive performance of cows fed different levels of silage are available in the literature.

The present work aimed to study the possibility of replacement of concentrate fed mixture with different levels of corn silage in rations of lactating Friesian cows, on nutrient digestibility coefficients, nutritive values, milk production and feed and economic efficiencies in additions to some reproductive parameters.

MATERIALS AND METHODS

The current study was carried out at the Experimental Animal Nutrition Unit, Sakha Animal Production Research Station, Animal Production Research Institute, Agricultural Research center, Ministry of Agriculture.

This study was divided into two trials, the first was intended to evaluate chemical composition, silage characteristics and nutritive values of corn silage. The second one was conduct to study productive performance of lactating Friesian cows fed rations containing 25, 50 and 75% corn silage.

Making silage:

Whole corn plant (SC10) was harvested at dough stage of maturity and chopped using Holland harvester chopper machine to 1:1.5 cm in length. The silage was ensiled in between mangers, while tractor was used to ensure pressing of silage. When the silo was filled, it was tightly covered by plastic sheet, thereafter covered by approximately 20 cm layer of soil to get anaerobic conditions. After one month, the silo was opened, color and odour were investigated and samples of ensiled corn were taken for chemical analysis.

Animal and feeding system:

A total of 18 lactating Friesian cows, weighing on average 530.6±37.3 kg LBW and from 1 to 5 lactations were allotted to 3 similar groups fed 25, 50 and 75% CS on DM basis, respectively. Feeding of the experimental cows started 3 weeks after calving according to NRC (1989). All cows were kept individually under open sheds. Feeding requirements were adjusted every week based on average body weight of the animals and daily milk yield.

Ingredient and composition of the tested rations on DM basis were given to the three experimental groups as following: Group (1): 66% concentrate feed mixture (CFM) + 25% corn silage (CS) + 9% berseem hay (BH) (R1), group (2): 41% CFM + 50% CS + 9% BH (R2), group (3): 25%

CFM + 75% CS. Feeding values of corn silage were determined at the 1st stage before the starting of feeding experiments.

The experimental rations were offered twice daily at 8.00 a.m. and 3.00 noon. Water was available all day times.

Digestion and nutritive values:

Three mature Friesian bulls were used for determining digestibility coefficients of corn silage. Fifteen days were considered as preliminary period followed by 7 days as a collection period. Bulls were individually fed corn silage *ad libitum* from 8.00 to 5.00 pm and feed residuals were daily weight, then individual feed intake was calculated. Fecal samples were collected from rectum twice daily during the collection period.

Three digestion trials were carried out after 2 months of feeding cows on the experimental rations to determine digestibility coefficients of the tested rations. Three cows from each experimental group were used in each digestion trial. Representative samples of faces were collected for successive 7 days. Acid insoluble ash was used as a natural marker according to Van-Keulen and Young (1977).

Chemical analysis and experimental procedures:

Chemical analysis using A.O.A.C. methods (1980) was performed on representative samples from all experimental feedstuffs and faces of the 1st and 2nd trial.

Cows were milked twice daily at 6.00 and 18.00 h by milking machine. Milk yield was daily recorded for each cow. Individual milk samples were monthly taken for determining chemical analysis. Milk composition (fat, protein, solids not fat, lactose and total solids) was determined using Milkoscan, (Model 133 B). Thereafter milk yield was adjusted as 4% fat corrected milk on the basis of the obtained fat percent.

Milk feed efficiency was calculated in terms of each kg DM, TDN and DCP required to produce 1 kg 4% FCM. Meanwhile, economic milk efficiency expressed as the cost of feed per kg 4% FCM produced, based on the following prices in Egyptian pounds LE/Ton milk, (1000), CFM, (532), BH, (385), and CS, (110).

Reproductive measurements:

Estrus was detected in cows of all groups during the postpartum period using bull teaser. Pregnancy diagnosis was performed using rectal palpation on 60 days of non-return cows and then postpartum first estrus and service intervals, service period, number of services/ conception and days open were computed.

Statistical analysis:

It was carried out according to general linear procedure of SAS (1996). Differences among treatment mean were tested by multiple range test of Dancan (1955).

RESULTS AND DISCUSSION

Evaluation of corn silage:

Chemical analysis of maize silage (Table 1) indicated that DM, OM, EE, CF, NFE and ash contents of corn silage are in ranging reported by

Mahmoud *et al.* (1992) ; Etman *et al.* (1994) ; Mohamed *et al.* (1999) and Bendary *et al.* (2001) with maize silage made from different local hybrids and varieties under Egyptian conditions.

The results of the digestibility trial (Table 1) indicated higher digestibility coefficients of all nutrients of corn silage. These values are within those obtained by Mahmoud *et al.* (1992) ;Mohamed *et al.* (1999); Elready (2000) ; Bendary *et al.* (2001) and El-Aidy. (2003).

The obtained nutritive value of tested maize silage on DM basis as TDN and DCP were 66.12%, 6.84%, respectively. These results are in agreement with those obtained by Mohamed *et al.* (1999) and Etman *et al.* (1994).

Generally, the present results reveal that maize silage could be considered a good feeding resource for ruminant animals.

Table (1): Chemical composition, and digestion coefficients of corn silage.

Item	DM (%)	Percentage					
		OM	CP	EE	CF	NFE	Ash
Chemical composition:							
	35.2	92.37	9.40	2.55	24.89	55.53	7.63
Digestion coefficients %:							
	-	69.35	72.76	68.18	65.75	70.23	-

Chemical analysis of tested rations:

Chemical analysis of feed stuffs and calculated chemical composition of tested rations are presented in table 2. The present results indicated that contents of CP, EE, NFE were the highest in ration (R1) of the control group (G1) as compared to the other rations, while R2 of the 2nd group (G2) and R3 of the 3rd group (G3) had the highest ash, DM and CF contents, respectively. The tendency of higher CP and lower CF contents in R1 compared with R2 and R3, respectively was attributed to the level of replacement of CFM by CS from 25 to 50 and 75%, respectively. Contents of CP were higher and contents of CF were lower in CFM as compared with CS.

Table (2): Chemical analysis of feed stuffs and calculated chemical composition of the experimental rations (on DM basis %).

Item	DM	Chemical composition %					
		OM	CP	EE	CF	NFE	Ash
Feed stuff:							
CFM*	90.61	92.59	16.2	3.60	11.40	61.39	7.41
CS	35.20	92.37	9.40	2.55	24.89	55.53	7.63
BH	93.98	87.12	12.42	2.85	24.52	41.33	12.88
Tested ration:							
R1 25% CS	65.09	92.05	14.21	3.25	15.83	58.76	7.95
R2 50% CS	50.79	92.02	12.46	3.05	19.25	57.26	7.98
R3 75% CS	41.56	92.41	11.08	2.84	21.50	56.99	7.59

*Concentrate feed mixture consisted of corticated cottonseed cake 32%, wheat bran 26%, soybean meal 5%, ground corn 22%, rice bran 12%, molasses 2.5%, limestone 0.5%.

Replacement of CFM with different levels of CS resulted in different roughages : concentrate rations in the experimental rations, being 66 : 34, 50: 50 and 25 : 75 in R1, R2 and R3, respectively (Table 2).

The present results are in accordance with those obtained by Mohamed *et al.* (1999), who found that the contents of DM, CP, EE and ash increased with increasing the level of CFM, while OM and CF increased with increasing the level of CS in the experimental rations.

Feed intake:

Data presented in table 3 show that average daily total dry matter intake did not differ significantly among dietary groups, although cows in G2 fed R2 showed slight tendency of higher total DM intake than those fed R3 and control ration (R1). This indicated that replacement of CFM by CS did not affect DM intake from CS diets on DM basis, these results are in agreement with those obtained by Broderick (1985) and Charmely and Robinson (1991).

In spite of the highest insignificant TDN intake in cows fed R2 (G2) followed by those fed R1 (G1) and R3 (G3), respectively, DCP intake was significantly ($P<0.05$), the highest in cows fed control ration (R1), followed by R2 and finally those fed R3. The differences were significant ($P<0.05$) only between R3 and the control ration (R1) (Table 3).

Table (3): Average daily feed intake of cows fed on the experimental rations.

Item	Experimental group		
	G1	G2	G3
Average daily intake (kg as fed)			
CFM	11.65±0.97	7.30±0.49	4.18±0.33
BH	1.50	1.50	-
CS	11.4±0.95	22.8±1.54	32.3±2.56
Average daily intake (kg/h/day):			
Total DM	15.98±1.33	16.06±1.09	15.16±1.20
TDN	10.64±0.89	10.85±0.73	10.25±0.78
DCP	1.61^{a}±0.13	1.44^{ab}±0.96	1.19^{b}±0.94

a and b means within the same raw with different superscripts are significantly ($P<0.05$) different.

These results are in accordance with those obtained by Cilliers *et al.* (1998) and Mohamed *et al.* (1999), who found that DCP intakes increased with increasing level of CFM in the ration. The considerable reduction in DCP intake from R2 and R3 compared with the control ration was associated with replacement of CFM with higher CP level by that of lower CP level in CS and nearly similar total DM intake.

Digestion coefficients and nutritive values:

Average digestion coefficients of different experimental rations fed to Friesian cows are presented in table 4. Results indicated that digestibility coefficients of DM, OM, CP, EE and NFE did not differ significantly between cows fed the experimental ration. However, CF digestibility was significantly ($P<0.05$) higher in R2 and R3 than the control rations (R1).

It is of interest to note significant (P<0.05) improvement in CF digestibility by increasing CF content in R2 and R3. This was supported by Taie et al (1998), who reported that CF digestion increased by increasing their contents in the diet. Moreover, Scharge *et al.* (1991) found that digestibility of CF increased with increasing the level of corn silage in rations.

Regarding the nutritive values in terms of TDN and DCP, R2 and R3 showed significantly (P<0.05) higher TDN values than that of R1, while R2 and R3 had significantly lower DCP values than the control rations (R1), being significantly (P<0.05) higher in R2 than R3 (table 4).

The higher TDN values in R2 and R3 than in R1 was mainly attributed to tendency of higher digestibility coefficients of DM and OM in R2 and R3 than the control rations (R1).

Table (4): Digestion coefficients and nutritive values of experimental rations (on DM basis).

Item	Experimental group		
	R1	R2	R3
Digestibility coefficients %			
DM	66.20±1.75	68.05±0.45	68.59±0.31
OM	68.77±1.61	70.41±0.21	69.77±0.21
CP	70.78±1.84	72.00±0.67	70.64±0.40
EE	76.28±2.57	72.79±0.66	75.19±0.77
CF	58.50^{b}±3.32	68.18^{a}±0.75	66.97^{a}±1.38
NFE	70.64±1.27	70.66±0.07	71.22±0.24
Nutritive values (%):			
TDN	66.61^{b}±0.34	67.54^{a}±0.20	67.62^{a}±0.43
DCP	10.06^{a}±2.26	8.97^{b}±0.10	7.82^{c}±0.01

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

These results are in agreement with those obtained by El-Sayes *et al.* (1997); Khinizy *et al.* (1997) and Mohamed *et al.* (1999), who found that TDN values of rations containing CS were higher than those of control ration. On the other hand, the significant (P<0.05) reduction in DCP by increasing CS level in R2 and R3 was associated with marked reduction in CP level in CS (9.4%) than in CFM (16.2%) and insignificant differences among experimental rations in CP digestion. The results agreed with those obtained by Taie *et al.* (1998) and Mohamed *et al.* (1999), who reported that DCP values decreased with decreasing the level of CFM.

Milk production:

Milk production in different dietary groups as daily milk yield (DMY), daily 4% FCM, Adjusted 305 day milk yield (AMY) and lactation period length as well as fat, protein and lactose yield are presented in table 5.

The present results showed that DMY, CFM and AMY were always significantly (P<0.05) higher in cows fed R2 and R3 than those in cows fed the control ration (R1).

In agreement with the present results Mohamed *et al.* (1999) and Elready (2000) indicated that inclusion of maize silage in the rations of

lactating Friesian cows improved average daily actual milk yield. Also, Bakr *et al.* (1998) found that DMY, FCM were higher for lactating Holstein cows fed maize silage (MS) or berseem (B) + MS without whole cottonseed than those fed B without cottonseed. Concerning the daily yield of fat, protein and lactose cows fed R3 showed significantly the highest yield, being higher by about 18.3 and 27.31% than the control group. The corresponding values of cows fed R2 were 16.61, 10.19 and 18.33% as compared to the control group, but the significant differences were found between R2 and R1 for lactose yield only. However, the differences between R2 and R3 were not significant (Table 5). Charmely and Robinson (1991) ; Bakr *et al.* (1998) and Alikhani and Chorbaui (1999) found that fat, protein and lactose content in the milk of Holstein cows increased with feeding maize silage.

Table (5): Average milk production and components milk yield in different experimental groups.

Item	Experimental group		
	G1	G2	G3
Average daily yield (kg):			
Actual milk	$16.49^{b}\pm0.62$	$18.59^{a}\pm0.60$	$18.98^{a}\pm0.74$
4% FCM	$15.95^{b}\pm0.72$	$18.33^{a}\pm0.61$	$18.98^{a}\pm084$
Adjusted 305 d	$3574.79^{b}\pm16.13$	$4073.74^{a}\pm18.6$	$3917.07^{a}\pm17.4$
Lactation period:	306	326	296
Average Yield (g/h/day):			
Fat	$623.3^{b}\pm0.5$	$726.8^{ab}\pm0.7$	$759.2^{a}\pm0.4$
protein	$509.5^{b}\pm0.2$	$561.4^{ab}\pm0.2$	$575.1^{a}\pm0.3$
Lactose	$802.0^{b}\pm0.3$	$949.0^{a}\pm0.4$	$1021.0^{a}\pm0.6$

a and b means within the same raw with different superscripts are significantly ($P<0.05$) different.

Superiority of cows fed R2 and R3 in their DMY and 4% FCM was related to increasing milk production as affect by feeding experimental rations. Also, TDN as nutritive value was almost higher in R2 and R3 compared with R1. This reflected in higher fat, protein and lactose yield for R2 and R3 than R1.

Milk production efficiency:

According to data of milk production and feed intake, results in table 6 show that fed conversion and feed efficiency were significantly ($P<0.05$) higher in cows fed R2 and R3 than R1 in terms of total DM, TDN and DCP intake per kg FCM. The differences between cows fed R2 and R3 in feed conversion and milk feed efficiency were not significant for DM and TDN intake, while significant ($P<0.05$) differences were found between R2 and R3 in term of DCP intake/kg milk produced, being higher of cows fed R2 than R3. Mohamed *et al.* (1992) and Elready (2000) mentioned that cows fed corn silage had higher production efficiency compared to cows fed wilted berseem. Also, Bendary and Younis (1997) and Elready (2000) found tendency of better conversion as TDN with feeding lactating cows on maize silage rations.

Economic feed efficiency:

Data in table 7 revealed that CFM showed the highest feed cost for control ration (R1) and (R2). However, the highest replacement of CFM by CS in R3 decreased feed cost of R3. Replacement of CS was reflected in lowering total feed cost of R2 and R3. Generally, the pronounced reduction in total feed cost with the considerable increase in milk yield resulted in decreasing feed cost per kg milk production by about 13.2 and 28.14% in R2 and R3 as compared to the control ration (R1).

Table (6): Feed conversion and milk feed efficiency of cows fed on the experimental rations.

Item	Experimental group		
	G1	G2	G3
Feed conversion (kg/kg 4% FCM):			
DM	1.00^{a}±0.05	0.88^{b}±0.03	0.80^{b}±0.04
TDN	0.67^{a}±0.03	0.59^{b}±0.02	0.54^{b}±0.03
DCp	0.10^{a}±0.05	0.08^{b}±0. 03	0.06^{c}±0.02
Feed efficiency (kg 4% FCM/kg):			
DM	0.99	1.14	1.25
TDN	1.49	1.69	1.85
DCP	9.91	12.73	15.95

a and b meanswithin the same raw with different superscripts are significantly (P<0.05) different.

It's worthynoting from the economical point of view that economic feed efficiency was markedly higher in cows fed R2 (266.7%) and R3 (328.94%) than the control (205.35%) being higher for R3 than R2 (Table 7).

In light of the foregoing resulted it could be concluded that R2 shows the best results from the nutritional point of view, however, R3 shows the highest economic efficiency. These results agreed with those obtained by Mehany (1999) who found that daily feed cost increased with increasing the level of concentrate mixture in the rations. Mohamed *et al.* (1999) and Mehany (1999) stated that feed cost of feeding decreased with increasing level of maize silage and decreeing the level of concentrate mixture in the rations.

It could be concluded that replacement of CFM by different levels of CS in rations of lactating cows at a rate of 50 or 75% could increase their milk production fed utilize efficiency and the economical return compared to the control ration.

Table (7): Economical efficiency of milk production of cows fed on the experimental rations.

Item	Experimental groups		
	G1	G2	G3
Average daily feed cost (L.E.):			
CFM	6.20	3.88	2.22
CS	1.25	2.51	3.55
BH	0.58	0.58	-
Total feed cost (L.E.):	8.03	6.97	5.77
Return of milk (L.E.)	16.49	18.49	18.98
Feed cost / kg FCM	0.503	0.380	0.304
Economical feed efficiency %	205.35	266.71	328.94

Reproductive measurements:

Data in Table (8) revealed that postpartum first estrus (PPEI) and service intervals (PPSI) did not differ significantly on treatment groups, but cows fed 50% CS (G2) tended to show the shortest intervals to 1st estrus and service as compared to G1 and G3. The significantly (P<0.05) shortest service period length (SP) in G2 than G1 and G3 was associated with significantly (P<0.05) lower number of services / conception (NS/C) in G2 than G1 and G3. As a result of reducing both postpartum first estrus and service in G2 than in G1 and G3, days open (DO) cows in G2 was almost significantly (P<0.05) shorter (88.2 days) than those in G1 (145.0 days) and G3 (135.8 days). Generally cows in G2 fed 50% CS showed the shortest PPEI, PPSI, SP and DO and the lowest NS/C as compared to the control and G3.

Table (8): Means (±SE) and range of different postpartum reproductive measurements of lactating cows in different treatment groups.

Item	Experimental groups		
	G1	G2	G3
PPEI x±SE	45.0±5.2	37.3±2.0	51.8±5.5
Range	30-66	31-45	41-77
PPSI x±SE	53.8±3.1	51.5±2.9	51.8±5.5
Range	45-66	41-60	41-77
SP x±SE	91.2±16.3[a]	39.6±13.9[b]	84.0±12.6[a]
Range	39-156	20-93	43-120
NS/C x±SE	4.8±0.7[a]	2.3±0.4[b]	5.2±0.6[a]
Range	3-8	1-4	3-7
DO x±SE	145.0±15.6[a]	88.2±13.9[b]	135.8±15.4[a]
Range	98-201	45-149	86-195

a and b means demoted within the same raw with different superscripts are significantly (P<0.05) different.

On the other hand, cows in G3 fed 75% CS did not differ significantly than the control group.

The present DO length in cows of G2 was almost less than 90 days, which indicated significant (P<0.05) improvement in reproductive performance of cows fed 50% CS. Cows breed aimed to achieve DO of not more than 3 months (Ghanah, 2000).

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الأداء الإنتاجى والتناسلى لأبقار الفريزيان الحلابة المغذاة على علائق تحتوى على مستويات مختلفة من سيلاج الأذرة

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تهدف هذه الدراسة إلى دراسة تأثير إستبدال العلف المركز بمستويات مختلفة من سيلاج الأذرة بالكيزان (٢٥% ، ٥٠% ، ٧٥%) على التركيب الكيماوى للعلائق المختبرة ومعاملات الهضم وإنتاج اللبن والكفاءة الغذائية فى الأبقار الفريزيان

أستخدم فى هذه الدراسة ١٨ بقرة فريزيان حلاب متوسط أوزانها ٥٣٠ + ٣٧,٣ كجم فى مواسم حلب من الأول وحتى الخامس قسمت إلى ثلاث مجموعات الأولى غذيت على ٦٦% علف مركز + ٢٥% سيلاج أذرة بالكيزان + ٩% دريس برسيم على أساس المادة الجافة ، والثانية غذيت على ٤١% ، ٥٠% ، ٩% علف مركز وسيلاج أذرة بالكيزان ودريس برسيم ، بينما المجموعة الثالثة غذيت على ٢٥% علف مركز ، ٧٥% سيلاج أذرة بالكيزان ، التحليل الكيماوى وتقييم سيلاج الأذرة أوضح أنه مصدر جيد لتغذية المجترات فقد كانت مجموع المركبات الغذائية المهضومة (TDN) ٦٦,١٢% والبروتين المهضوم (DCP) ٦,٨٤% ، أوضحت النتائج أن قيم CP EE NFE (٥٨,٧% ، ٣,٢٥% ، ١٤,٢%) كانت أعلى فى مجموعة الكنترول عن المجموعتين الثانية والثالثة بينما إرتفعت قيمة CF ٢١,٥% فى المجموعة الثالثة ، لم يكن لمتوسط المادة الجافة المأكولة (TDM) ومجموعة المركبات الكلية المهضومة (TDN) تأثير معنوى فى المجموعات الغذائية بينما البروتين المهضوم المأكول DCP إنخفض معنويا فى المجموعة الثالثة عن الأولى (١,١٩ مقابل ١,٦١ كجم / رأس /يوم) ، لم يكن هناك إختلافات معنويه لمعاملات الهضم فى المجموعات الغذائية فى كلا من DM, OM, CP, EE, NFE بينما وجد إختلاف معنوى فى معامل هضم الألياف بين كلا من المجموعة الأولى وكلا من الثانية والثالثة (٥٨,٥% ، ٦٨,١٨% ، ٦٦,٩٧%) ، إرتفع معنويا مجموع المركبات الكلية المهضومة TDN فى المجموعة الثانية والثالثة (٦٧,٥٤% ، ٦٧,٦٢) عن المجموعة الأولى ٦٦,٦١% بينما إنخفض معنويا البروتين المهضوم فى المجموعتان الثانية والثالثة (٨,٩٧ ، ٦,٨٢) عن المجموعة الأولى(١٠,٠٦).

متوسط إنتاج اللبن وكذلك اللبن المعدل الدهن ٤ % إرتفع معنويا فى كل من المجموعة الثانية والثالثة (١٨,٥٩ ، ١٨,٩٧) عن المجموعة الأولى (١٦,٤٩) ، الكفائة التحويلية والغذائية كانت مرتفعة معنويا فى كل من المجموعة الثانية والثالثة عن المجموعة الأولى لكل من المادة الجافة الكلية TDM والمركبات المهضومة الكلية TDN والبروتين المهضوم DCP لكل كيلو جرام لبن معدل الدهن ٤% ، الكفاءة التحويلية وكفاءة إنتاج اللبن كانت غير مختلفة معنوية بين المجموعة الثانية والثالثة فىالمادة الجافة DM والمركبات المهضومة الكلية TDN

وجدت إختلافات معنويه بين المجموعتين الثانية والثالثة فى البروتين المهضوم المأكول DCP لكل كيلو جرام لبن

الكفاءة الإقتصادية كانت مرتفعة للمجموعات الثالثة والثانية عن المجموعة الأولى وكذلك للمجموعة الثالثة عن الثانية

أظهرت المجموعة الثانية أفضل أداء تناسلى حيث أعطت أكثر فترة حتى التلقيح (٣٦,٦ يوم) وكذلك الأيام المفتوحة (٨٨,٢ يوم) وإنخفضت نسبة عدد التلقيحات اللازمة للإخصاب (٢,٣).