

Utilization of Discarded Dates as a Source of Energy in Silage Fermentation and the Effect of Silage Produced on the Performance of Dairy Cows

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ABSTRACT

This study was conducted to evaluate the effect of partial substitution of corn grain by discarded dates on silage quality and their effect on digestibility, milk production and composition. Sixteen crossbreed lactating Friesian cows were assigned to four balanced groups and fed individually for 90 days on experimental rations whereas: all the groups were received a basal diet with one of four kinds of silages as follows: 100 % crushed corn grain (T1), 75 % crushed corn grain + 25% discarded dates (T2), 50 % crushed corn grain + 50 % discarded dates (T3) and 25 % crushed corn grain + 75 % discarded dates (T4) on gross energy based, respectively. Results found that there was slight tendency to increase silage DM content with increasing the entry level of discarded dates. Silages containing discarded dates displayed OM and ash contents nearly identical to those of the control diet. The pH values of the tested silage samples ranged from 3.89 in S1 to 3.72 in S4. The ammonia nitrogen (NH₃-N) concentration in silage was decreased with increasing proportion of discarded dates in the silage. The digestibility coefficient of DM and OM were significantly ($P < 0.05$) higher in the diets containing discarded dates than in the control diet. However, there was insignificant ($P > 0.05$) increases in the digestibility of CP, CF, NDF and ADF for dietary treatment T2, T3 and T4 compared to the control (T1). Also, no significantly ($P > 0.05$) different of dry matter intake was observed among dietary treatments. The highest actual milk and 4% fat corrected milk yield were recorded with T4 (10.87 and 10.24, respectively), while the lowest values for these items were corresponding to T1 (10.06 and 8.56, respectively) but the differences were not significant. Regarding of milk pH value, milk protein and ash contents have the same trend among groups with nonsignificant different among groups. However, there were significant differences in the milk percentages of fat, solid not fat (SNF), lactose and total solids between T1 (the lowest one) and each of T2, T3 and T4. Results of this study indicated that partial replacement of yellow corn grains by discarded dates up to 75% as a source of energy in silage did not show any negative effect on digestibility, feed efficiency, milk yield and composition in crossing Friesian cows.

Keywords: discarded dates, silage, digestibility, milk yield and composition, lactating cows.

INTRODUCTION

Corn grains considered as an excellent energy source which are highly fermented (Andrae *et al.*, 2001) to produce high-quality corn silage by the controlled fermentation of high moisture herbages. Whereas, changes in fermentation characteristics are affected by the chemical composition of corn silage changes which can influence intake and milk production (Huhtanen *et al.*, 2007; Khan *et al.*, 2015) and the information on the effect of discarded dates as a source of energy in Silage Preparation is limited.

Globally, corn prices have a two- to four-fold increase dramatically that due to its use as biofuels with the increase of demand for animals' feeds. The increases in corn price encouraged nutritionists to replace corn with alternative energy sources with competitive prices such as date residues which could be used as an energy source to replace a part of the concentrates in the ration (Rekik *et al.* 2008; Ziaei, 2010; Mebirouk-Boudechiche and Araba, 2011) that may prove an economical and environmental advantageous.

Date palm is one of the oldest domesticated fruit crops (since 4000 BC in Ancient Egypt), and one of the most important growing in desert areas (Ramawat, 2010). The top five producing countries - Egypt, Iran, Saudi Arabia, Pakistan and Iraq were responsible for 69% of total world production in 2001 (FAO, 2003). The quantity of cull dates estimated by about 20% of all dates production (Al-Yousef *et al.*, 1993) which can be utilized as a cheap non-conventional ingredient and relatively high in nutrient content in animal feeding to improve productivity (Costa *et al.*, 2009). Especially, discarded dates are highly content in energy as Total Digestible Nutrient (TDN), being palatable for livestock (Al-Dobaib *et al.* 2009). While containing reasonable quantity of the phenolic profiles (Mansouri *et*

al., 2005), volatile compounds (Harrak *et al.*, 2005), flavonoid glycosides (Hong *et al.*, 2006) and antioxidant properties of the aqueous extracts of the date fruit (Vayalil, 2002). Some reports indicated that there has been an increase in growth and efficiency of digestion in sheep using discarded dates (Alhomidy *et al.*, 2011). Also, Bayati Zadeh *et al.* (2013) indicated that utilization efficiency of nitrogen in the rumen increased with the usage of discarded dates as supply energy.

So, this experiment was aimed to evaluate the effect of partial substitution of corn grain used in silage preparation by discarded dates on chemical composition of silage, intake, total tract apparent digestibility of nutrients, milk production and composition in diets for dairy cows.

MATERIALS AND METHODS

This study was conducted at El-Serw Experimental Station belonging to the Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Egypt.

Silage making: Corn-stalk hybrid (CSH) chopped by chopper machine to 2- 5 cm length where moisture content at the ensilage time was 70%, in overage. The discarded date (DD) was mechanically grinded by a grinder machine into little pieces to 3-5 mm. Crushed corn grain (CCG) added at a rate of 30 kg per ton of CSH (30% DM) as control silage, while the discarded dates were added at 25, 50 and 75% as partially replacement of corn on gross energy based, respectively. Urea was added by 0.5% of chopped corn stalk for each kind of silage according to (Abo-Donia *et al.* 2009). After ensiling for a period of 45 days the samples were taken to test the physical, fermentative characteristics and chemical analysis. The four kinds of silages were available for feeding

experimental animals after finishing the ensiling period. Chemical composition after ensiled is shown in (Table 1). Samples (5 g/100 ml distilled water) in mixture were homogenate then filtered through double layers of cheesecloth, and then the filtrate was used to determine silage pH directly by using HANNA pH-meter (model HI 8424), ammonia-N (AOAC, 1995) and TVFA's (Warner, 1964). Lactic acid concentration was determined by methods of Analytical Chemistry of Foods (James, 1995).

Feeding trails: Sixteen crossbreed Friesian cows in the 2nd and 3rd season of lactation with average body weight 450 Kg in their early lactation stage were used. The experimental cows were assigned to four balanced groups according to body weight (four animals each). Animals were housed indoors and fed individually with adapted (after parturition directly) on their experimental rations for 10 days before starting of the feeding trail that lasted for 90 days. The animals were assigned to one of four tested diets where the concentrate feed mixture (CFM) were offered to animals at two times daily just before milking at 5:00 a.m., and before the second milking at 5.00 p.m. The amount of silage, berseem and rice straw were combined and divided into two equal parts separately of each, daily. The diets were formulated to be iso-caloric and iso-nitrogenous according to NRC (2001) and adjusted biweekly according to body weight, milk production and fat percentage. Clear fresh water was offered free daily. The first group was received a basal diet contained CFM + silage containing CCG + berseem + rice straw, 2nd group received a diet containing CFM + silage with (25% DD+75% CCG) + berseem + rice straw, the 3rd group received a diet containing CFM + silage with (50% DD+50% CCG) + berseem + rice straw and the 4th group received a diet containing CFM + silage with (75% DD+25% CCG) + berseem + rice straw. The diets were adjusted biweekly according to animal's body weight, milk production and fat percentage. Animals were machine individually milked twice daily at 5.00 a.m. and 5.00 p.m. and the morning and evening milk yield were daily recorded. Every two weeks, evening and morning milk samples were taken and stored at -20°C for analysis. Milk samples were analyzed for fat, protein, lactose; solid not fat (SNF), total solids (TS) and ash contents by Milko SCAN 133 BN Foss Electric, Denmark.

Digestibility: The digestion trials were carried out at the end of the feeding trial and lasted for 10 days. Nutrients digestibility were estimated by acid insoluble ash (AIA) method (Van Keulen and Young, 1977). Fecal samples were collected twice daily at 6.00 a.m. and 6.00 p.m. Composite feed and fecal samples were chemically analyzed according to A.O.A.C. (1995). Chemical composition of ingredients and the experimental rations are presented in Tables 1, 2 and 3. Neutral detergent fiber (NDF) and acid detergent fiber (ADF) were determined according to Goering and Van Soest (1970). Gross energy (GE) was measured according to (Weiss, 2007) using the following values for each carbohydrates, crude fiber, protein and fat (4.3, 4.3, 5.6 and 9.2 Kcal/g, respectively).

Statistical analysis: Data were statistically analyzed using the general linear model program of SAS, (2009). The differences among means were tested using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition: The chemical compositions of the experimental silages with CCG or replacing with DD (% on a DM basis) are showing in Table 1. There was slight tendency to increase DM content with increasing the entry level of DD. This increase was a result of replacing corn grains (4.5793 Mcal/kg) with different levels instead of discarded dates (4.1501 Mcal/kg) which increased the added quantity of DD. These results are in good harmony with those of Al-Dobaib (2005), who reported that the DM content was raised in diets containing 0, 10 and 20% DD. Silages containing DD displayed OM and ash contents nearly identical to those of the control diet. The experimental silages containing 25% (S2), 50% (S3) and 75% (S4) DD showed slightly lower contents of CP, EE and gross energy that due to low percentages of CP and EE in DD. The chemical composition of the diets was comparable to that reported in the literature for similar diets. For instance, Al-Hooti *et al.* (1995) reported that dates had lower CP contents which are the main limitation of dates in the ruminant diet. In contrast, the CF contents were slightly higher in S4, S3 and S2 (31.68, 31.59 and 31.49 %, respectively) compared with S1 (31.34 %) as a result of higher content of CF in DD (8.61 %) than that in corn grains (2.66 %) and these results are in agreement with those reported by Allam *et al.* (2013).

Table 1. The effect of replacing of CCG with DD in silage preparation on chemical composition (% on DM basis).

Item	S1	S2	S3	S4
DM	34.69	34.73	34.78	34.83
OM	91.19	91.14	91.12	91.01
CP	10.31	10.19	10.03	9.88
CF	31.34	31.49	31.59	31.68
EE	2.08	1.97	1.90	1.81
Ash	8.82	8.86	8.88	8.99
NFE	47.47	47.49	47.60	47.64
NDF	49.22	49.42	49.56	49.67
GE (M Kal/Kg DM)	4.158	4.148	4.142	4.131

Data in Table 2 showed that the pH values of the tested silage samples ranged from 3.89 in S1 to 3.72 in S4. This is probably due to a direct effect of the higher content of NFE in DD (82.14 %) compared with the corn grains (80.62 %) which is a favorable condition for the growth of lactobacillus bacteria and inhibit the growth of undesirable anaerobic microorganisms; thus, the production of lactic acid, which is the main acid responsible for reducing silage pH. These results indicated that the pH values are fell within the normal range of good quality silage (Kung and Shaver, 2001). The results are in agreement with those of Al Dobaib *et al.* (2009) who reported that using of DD reduced pH value. The ammonia nitrogen (NH₃-N) concentration in silage was decreased with increasing proportion of DD in the silage; whereas, the highest value of ammonia-N was recorded with control silage (0.2541 % of DM). Thus, the decrease in ammonia concentration can be explained by a decrease in protein breakdown in the silo due to the rapid decrease in silage pH (McDonald *et al.*, 1991). Silage containing higher level of DD (S4) gave higher values of lactic acid (5.28% of DM), lactic

acid/acetic acid ratio (3.11) and total count of lactic acid bacteria (6.28 log cfu g⁻¹ fresh silage) compared to all other treatments. These results were similar to that reported by Henderson (1993) who found the population of lactic acid bacteria increased during ensiling with DD, where the values closed to 7 log cfu/g. At the same time, the silages containing DD displayed acetic acid, propionic acid and butyric concentrations nearly identical to those of the control diet. According to the fermentation profiles obtained for the parameters indicating all values were within the range for good silage characteristics (Kaiser and Piltz, 2009).

Table 2. Fermentation profiles of tested silages after 45 days of ensiling

Item	Experimental Silage			
	S1	S2	S3	S4
pH	3.89	3.83	3.76	3.72
NH ₃ -N (% of DM)	0.454	0.446	0.439	0.434
Lactic acid (% of DM)	5.12	5.20	5.24	5.28
Acetic acid (% of DM)	1.73	1.71	1.71	1.70
Propionic acid (% of DM)	0.24	0.24	0.23	0.23
Butyric (% of DM)	0.23	0.23	0.22	0.22
Lactic acid/Acetic acid	2.96	3.04	3.06	3.11
Lactic acid bacteria (log cfu g ⁻¹ fresh silage)	6.19	6.22	6.26	6.28

Chemical composition of the experimental rations is shown in Table 3 was calculated from the chemical composition of feed ingredients (Table 1) and each group dry matter consumed. The experimental rations were almost iso-caloric and iso-nitrogenous. The corresponding EE value was 2.08, 1.97, 1.90 and 1.81% for T1, T2, T3 and T4, respectively. In spite of, OM, CP and GE content were slightly decreased with ration containing DD silage, the CF content were slightly decreased. The crude fiber, NDF and NFE were slightly increased with ration containing DD silage. These results are consistent with the findings of El-Hag *et al.* (1993) and Al-Dobaib (2005).

Digestibility trails: Data in Table 4 show the digestibility coefficients of the experimental diets. The digestibility coefficient of DM and OM were significantly higher (P<0.05) in the diets containing DD than in the control diet. However, there was insignificant (P<0.05) increases in the digestibility of CP, CF, NDF and ADF for dietary treatment T2, T3 and T4 compared with the control (T1). Al-Yousef *et al.* (1993), Hemeidan *et al.* (1993) and Al-Dobaib and

Table 4. Digestibility and nutritive value of experimental diets.

Items	Experimental groups				±SE
	T ₁	T ₂	T ₃	T ₄	
Digestion coefficients (%)					
Dry matter, DM	68.02b	69.67a	69.94a	70.23a	0.290
Organic matter, OM	71.53b	72.07ab	72.97a	73.35a	0.422
Crude protein, CP	72.65	72.96	73.73	73.97	0.508
Ether extract, EE	80.84c	81.53bc	82.66ab	83.48a	0.527
Crude fiber, CF	61.98	62.09	62.26	62.54	0.425
Nitrogen free extract, NFE	59.76	59.54	59.06	58.93	0.474
Neutral detergent fiber, NDF	58.86	58.91	58.97	59.58	0.399
Acid detergent fiber, ADF	52.53	53.19	53.26	53.58	0.374
Nutritive value					
TDN (%)	66.21b	66.70ab	67.53ab	67.78a	0.417
DCP (%)	7.99	8.06	8.17	8.08	0.118

^{ab} and ^c: Means denoted within the same row with different superscripts are significantly different at (P<0.05).

Feeding trails: Feed intake, milk yield, composition and feed conversion parameters of lactating crossbred Friesian cows fed the experimental rations are given in Table 5. In

Ahmed (2002) found that inclusion of dates in ration didn't caused a drop-in digestion coefficient of CP and CF. This finding is contrary to the results of Al-Dobaib and Ahmed (2002), who found that the addition of DD up 44% to the Najdi lambs diets reduced the digestibility of protein and of soluble carbohydrates. Slight increase was shown with feeding silage containing DD with dairy cow's diet compared to crushed corn grain, but the differences were not significantly. Al-Kinani and Al-Wash (1975) reported that, the presence of culling dates improved the digestibility coefficients of fiber. Significant (P<0.05) differences were found among all diets in the EE digestibility. Digestibility of NFE increased from 58.93% with T4 diet to 59.76% with control diet. The improvement of nutrients digestibility in the diets containing DD may be regarded to the improvement in rumen characteristics which might be due to the presence of growth-promoting compounds in dates (Ismail, 2000). This data is in agreement with the finding of Al-Yousef *et al.* (1993), Hemeidan *et al.* (1993), Ahmed and Al-Dobaib (2000) and Javidan and Khezri (2013). Furthermore, results in Table 4 showed the nutritive values of the experimental diets expressed as percent total digestible nutrients (TDN) and percent digestible crude protein (DCP); where, the DCP values of the diet containing DD (P>0.05) were similar to those of the control diet. Diet T4 had the highest significantly (P<0.05) TDN value (being 67.78%), while the control diet had the lowest TDN value (being 66.21%). The same trend was observed by Abd El-Rahman *et al.* (2012), who found that the TDN value of total discarded instead of corn grains was insignificantly higher than that of other levels of replacement.

Table 3. Chemical composition of experimental rations consumed by lactating cows (% on DM basis)

Item	T1	T2	T3	T4
DM	68.61	68.62	68.63	68.64
OM	88.40	88.39	88.38	88.36
CP	11.55	11.52	11.49	11.46
CF	25.46	25.49	25.51	25.52
EE	2.02	1.99	1.98	1.96
Ash	11.61	11.61	11.62	11.64
NFE	49.38	49.39	49.41	49.42
NDF	46.72	46.72	46.72	46.72
GE (M cal/Kg DM)	4.050	4.048	4.047	4.045

spite of no significantly (P<0.05) different of dry matter intake (DMI) among dietary treatments, DMI in ration containing silage with DD was slightly higher. These

results might be attributed to higher palatability and soluble carbohydrates of dietary containing silage with DD which increased the rate of passage during the gut and thereby making the animal able to eat more (Mertens, 1996). Also, these results could be explained by a negative correlation between intakes and total acid concentration and propionic acid concentration in lactating cows (Huhtanen *et al.*, 2007). These results are in matching with those obtained by Hemeidan *et al.* (1993), who found that the addition of DD up to 33% did not negatively affect the feed intake of Najdi lambs (Hemeidan *et al.*, 1993). The highest actual milk produced and 4% fat corrected milk (FCM) yield were recorded with T4 (10.87 and 10.24, respectively), while the lowest values for these items were corresponding

to T1 (10.06 and 8.56, respectively). Milk yield of groups T2 and T3 were in the middle but the differences were not significant. This result may be attributed to the improvement of nutrients digestibility and the presence of growth-promoting compounds in DD (Ismail, 2000). The same trend was observed by Khattab (2013) who found that milk yield was not significantly affected when lactating Barki ewes fed diets containing 0, 50 or 100% dates in replacing corn grains. In other studies, replacing a portion of the concentrate in the diet of lambs with 11% and 35% DD did not negatively affect animal productivity (Al-Yousef *et al.*, 1993; Hemeidan *et al.*, 1993 and Al-Dobaib, 2005).

Table 5. Feed intake, feed conversion, milk production and composition of dairy cows fed the experimental rations

Item	Experimental rations				
	T1	T2	T3	T4	SE
Total dry matter intake, kg/h/d.	13.69	13.73	13.72	14.23	0.211
	Milk yield				
Actual milk, kg/h/d	10.06	10.41	10.74	10.87	0.596
FCM (4 % fat), kg/h/d.	8.56	9.65	9.95	10.24	0.577
	Milk composition, %				
Fat	3.00b	3.51a	3.51a	3.60a	0.052
Protein	2.97	3.17	3.12	3.09	0.065
Lactose	4.47c	4.57b	4.60b	4.69a	0.018
SNF	8.07b	8.39a	8.37a	8.44a	0.070
TS	11.07b	11.90a	11.88a	12.04a	0.057
Ash	0.63	0.65	0.65	0.65	0.015
pH	6.60	6.62	6.61	6.63	0.027
	Feed efficiency				
Kg DM intake /Kg FCM	1.620	1.435	1.388	1.413	0.088
Kg TDN intake/ Kg FCM	1.072	0.958	0.938	0.955	0.059
Kg N intake / Kg FCM	0.030	0.025	0.022	0.028	0.002

Regarding of milk pH value, milk protein and ash contents, they took the same trend among groups and both values did not significantly ($P>0.05$) differ among groups. However, there were significant differences ($P<0.05$) in the milk percentages of fat, solid not fat (SNF), lactose and total solids between T1 (the lowest one) and each of T2, T3 and T4. Moreover, these results agreed with those obtained by Al-Dobaib *et al.* (2009), who reported that the addition of discarded dates of Aradi goats ration associated was significantly higher milk protein and solids not fat contents, but the other milk constituents were not different. For the feed efficiency expressed as the amounts of DM, TDN and N intake required to produce kg 4% FCM, there were not significantly ($P>0.05$) affected by the substitution levels of CCG by DD compared to control group. However, the feed efficiency values of T2, T3 and T4 were approximately close and had the higher values compared with the control group. In this respect, these results might be attributed to the increases in the yield of actual and 4% FCM; whereas, the same trend was observed by Abd El-Rahman *et al.* (2012), who reported that the TDN value of replacement of yellow corn by cull dates was insignificantly higher than that free from cull dates.

CONCLUSION

Results of this study indicated that partial replacement of yellow corn grains by DD up to 75% as a source of energy in silage did not show any negative effect on dry matter intake, digestibility, feed efficiency, milk yield and composition. Using DD up to 75% reduced the nutrition costs and overall production costs in crossbred Friesian cows.

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الاستفادة من فرزرة التمور كمصدر للطاقة في تخمرات السيلاج وتأثير السيلاج الناتج على أداء الأبقار الحلابة فوزى محمد أبودنيا¹، جمال إبراهيم الإمام¹، محمد الشورى¹، أمل محمد عبد المجيد فايد¹، هاتم عبد الرحمن الشيخ¹ و طلعت حسن السواح²

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أجريت هذه التجربة بهدف تقييم الإحلال الجزئى لفرزرة التمور محل حبوب الذرة المجروشة عند إعداد السيلاج، وتأثير ذلك على التركيب الكيماوى للسيلاج الناتج، ومعاملات الهضم، وإنتاج اللبن وتركيبه فى الأبقار الحلابة. حيث استخدم فى هذه التجربة 16 بقرة فريزيان حلابة، تم تقسيمهم الى أربعة مجاميع متوازنة، وغذيت فريديا لمدة 90 يوما على العلائق المختبرة، حيث غذيت كل المجاميع على عليقة المقارنة بالإضافة الى واحد من أربعة أنواع من السيلاج المختبر، والتي تم فيها استبدال فرزرة التمور بدلا من الذرة وذلك على أساس محتوى الطاقة، وكانت كالتالى: T1 (العليقة المقارنة) تحتوى على سيلاج مصدر الطاقة الاساسى فيه 100% من حبوب الذرة المجروشة (S1). T2 عليقة تحتوى على سيلاج مصدر الطاقة الاساسى فيه 75% حبوب الذرة المجروشة + 25% فرزرة التمور (S2). عليقة T3 تحتوى على سيلاج مصدر الطاقة الاساسى فيه 50% حبوب الذرة المجروشة + 50% فرزرة التمور (S3). عليقة T4 تحتوى على سيلاج مصدر الطاقة الاساسى فيه 25% حبوب الذرة المجروشة + 25% فرزرة التمور (S4). وكانت النتائج كالتالى: كان هناك ميل بسيط لزيادة المحتوى من المادة الجافة مع زيادة مستوى ادخال فرزرة التمور. بينما كان محتوى السيلاج المحتوى على فرزرة التمور مطابق تقريبا فى محتواه من كلا من المادة العضوية والرماد لسيلاج مجموعة التحكم. قيم pH لعينات السيلاج المختبرة تراوحت بين 3.89 فى السيلاج رقم 1 الى 3.72 فى السيلاج رقم 4. تركيز الأمونيا فى السيلاج مال الى الإنخفاض مع زيادة نسبة فرزرة التمور بالسيلاج. وأظهرت نتائج تجربة الهضم أن: معاملات هضم كلا من المادة الجافة والعضوية كانت أعلى بصورة معنوية فى العلائق المحتوية على فرزرة التمور مقارنة بعليقة المقارنة. فى حين الزيادة كانت غير معنوية فى معاملات الهضم الخاصة بالبروتين والألياف والألياف الذائبة فى المحاليل المتعادلة والألياف الذائبة فى المحاليل الحامضية فى العلائق المحتوية على فرزرة التمور عند المقارنة بعليقة المقارنة. كما أظهرت أيضا نتائج تجربة إنتاج اللبن أنه: لم تظهر فروق معنوية بين المعاملات المختلفة والعليقة المقارنة فى قيم المادة الجافة المأكولة. أعلى قيم لإنتاج اللبن واللبن المعدل سُجلت مع العليقة رقم 4 (10.87 و 10.24 ، على التوالي) فى حين أن أقل القيم قد سُجلت فى عليقة المقارنة (10.06 و 8.56 على التوالي)، مع عدم وجود فروق معنوية. أخذت قيم pH اللبن والبروتين والرماد نفس الاتجاه بين المعاملات. فى حين ظهرت فروق معنوية فى قيم كلا من نسبة الدهن والجوامد غير الدهنية واللاكتوز والجوامد الكلية بين مجموعة المقارنة (أظهرت أقل القيم) وباقي المعاملات المحتوية على فرزرة التمور. من نتائج هذه الدراسة يظهر أن الإحلال الجزئى لحبوب الذرة الصفراء بواسطة فرزرة التمور حتى 75% كمصدر للطاقة عند عمل السيلاج لم تظهر أى أثار سلبية على معاملات الهضم والكفاءة الغذائية ومحتوى اللبن وتركيبه وذلك عند تغذيتها للأبقار الفريزيان الحلابة.