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EFFECT OF MAIZE SILAGE WITH BERSEEM ON THE PRODUCTIVE PERFORMANCE OF DAIRY BUFFALOES

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SUMMARY

This study was conducted to investigate the performance of lactating buffaloes as affected by inclusion of maize silage with berseem in their diets compared with feeding berseem alone in winter feeding. Twnenty five lactating buffaloes with average body weight of 500 to 600 kg at their 2nd to 5th lactation were used after 6 weeks of calving for a 120 days experimental period. Buffaloes were divided into five similar groups 5 animals in each group. Rations were formulated on DM basis to contain different levels of wilting berseem (WB) in combination with concentrate feed mixture (CFM) and maize silage (MS) as follow: R_1, the control WB, R2-69.50% WB + 30.50% CFM, R_3 52.60% WB + 47.40% CFM; R_4 34.00% WB + 31.30% CFM + 34.70% MS and R_5 36.30% WB + 49.60% CFM + 14.10 MS. Maize silage produced contained on DM basis 94.31% OM, 8.72% CP, 2.34% EE, 19.22% CF, 64.03% NFE and 5.69% ash. Also, it has normal values of pH, lactic acid, total VFAs concentrati-on and has high content of TDN and DE (70.58% and 3111.9 kcal/kg DM) but low content of DCP (5.85%). On DM basis TDN and DE values were highly significant in maize silage containing rations (R_4 and R_5), while, the lowest value was recorded with wilting berseem R_1. Buffaloes fed the 2nd, 3rd, 4th and 5th tested rations produced 10.39 kg/day (112.0%), 9.95 kg/day (107.2%), 10.64 kg/day (114.7%) and 10.89 kg (117.7%) 7% FCM, respectively compared with 9.28 kg/day (100%) of the control group. The fat, protein, lactose, solids not fat (SNF) and total solids (TS) contents of milk were significantly influenced by feeding tested rations. There were no significant differences among treatments in both feed efficiency and feed conversion values. Buffaloes fed wilting berseem milk production was the most profitable, from the economic point of view while the other tested rations showed nearly similar values. The feeding costs/kg 7% FCM were 34.98, 50.28, 54.88, 49.44 and 54.63 Pt, for groups 1, 2, 3, 4 and 5, respectively.

***Keywords:** lactating buffaloes, maize silage, berseem.*

INTRODUCTION

Berseem (*Trifolium alexandrinum*) is the main forage crop which is usually fed *ad libitum* as a common practice in Egypt during winter. Feeding berseem with its narrow energy/protein ratio usually covers 96% of energy and 177% of protein requirements of animals in winter season (Youssef, 1978) and represents about 60% and 79% from energy and protein available per year for ruminal feeding (El-Serafy, 1991). Consequently, animals would cover their energy requirements through hepatic gluconeogenesis and excretion of excessive N as urea. Otherwise the excretion of urea also requires energy with an average of 2,9 kJ=g urea. Moreover, the wide Ca/P ratio in berseem (Abdel Rahman *et al.* 1993) would depress gastrointestinal absorption of some other minerals (e.g. phosphorus, zinc and manganese) and may cause lower reproductive performance and induce parturient paresis (Abdel Rahman *et al.*, 2001).

Accordingly, many investigations have been carried out to improve the utilization of berseem (Gihad *et al.*, 1971; Tony *et al.*, 1977 and Etman *et al.*, 1987). This improvement may be achieved through feeding other feedstuff with berseem as a source of energy to improve the utilization of its valuable protein which is generally wasted when berseem is fed as the sole feed. Surplus berseem can be preserved as hay or silage for summer feeding.

However, utilization of maize silage has increased rapidly as a forage for dairy cattle in Egypt. This 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). The high energy content along with cheap price of maize silage may promote to use it with berseem for feeding ruminants.

Moreover, incorporation of maize silage along with concentrate feed mixture and berseem may correct such dietary disorders as accompanied with traditional winter feeding (*ad lib.* berseem). Therefore, the present study has been carried out to evaluate maize silage in rations of lactating buffaloes and study the performances as affected by inclusion a combination of maize silage, concentrate feed mixtures and berseem in their rations as compared to traditional winter ration.

MATERIALS AND METHODS

This study was carried out at Mahallet Mousa Animal Production Research Station, Animal Production Research Institute, Ministry of Agriculture. The experiment lasted for 120 days (from January to the end of April 1999).

Whole maize plant materials from single cross 10 (SC 10 hybrid) was ensiled at doughy stage of maturity. The plants were chopped (0.5-1.0 cm length) using chopping machine and ensiled in between mangers using wheel tractor to ensure good pressing and backing. When silo was filled, it was tightly covered by plastic sheet then covered by approximately 20 cm layer of soil to get anaerobic conditions. After 2 months, the silo was opened, colour and odour were checked and samples were taken for chemical analysis before starting the feeding trails.

Values of pH were directly determined using Orion 680 digital pH meter. Lactic acid was determined by titration with 0.1 N sodium hydroxide solution using 0.5 ml of phenolphthalein indicator according to the method of Analytical Chemistry of Foods (1995) using the following equation:

$$\text{Lactic acid} = \frac{\text{ml of NaOH} \times 0.09 \times 100}{\text{Sample weight}}$$

Total volatile fatty acids (TVFA's) concentrations were determined according to the method of Warner (1964). Ammonia nitrogen was determined using saturated solution of magnesium oxide distillation according to the method of A.O.A.C. (1990).

Twenty five lactating buffaloes 500-600 kg live body weight in the 2[nd] to 5[th] lactation were used after 6 weeks of calving. Buffaloes were divided into five similar groups (5 heads per each group) according to average milk production and phase of lactation. Buffaloes were individually fed according to Animal Production Research Institute (APRI) allowances for lactating buffaloes (1997). Daily rations were adjusted every week according to the change of body weight and milk production. The 2nd, 3rd and 4th cuts of berseem were used and it was wilting for 1 or 2 days according to weather before using it for feeding.

Rations contained (on DM basis): 30.5% concentrate feed mixture (CFM) and 69.50% wilting berseem (WB)(R_2), 47.40% CFM and 52.60 WB (R_3), 31.30% CFM, 34.00% WB and 34.70% maize silage (MS) (R_4), 49.60% CFM, 36.30% WB and 14.10% MS (R_5) while R_1 consisted of WB only as the farmers use it for feeding their animals in winter season in some areas.

Concentrate feed mixture consisted of 32% undecorticated cotton meal, 26% wheat bran 20% yellow corn, 12% rice bran, 5% linseed meal, 2% molasses, 1.0% salt and 2.0% limestone.

Considered feeding values in terms of total digestible nutrients (TDN) and digestible crude protein (DCP) on DM basis were 65 % and 13.5% for concentrate feed mixture, 61.3% and 13.5, 60.61% and 10.27% for fresh berseem 2nd and 3rd cuts, respectively (Ministry of Agriculture Agric. Res. Cent. A.P.R.I., 1997).

Wilting berseem was offered to buffaloes of the control group *ad libitum* from 8.0 a.m to 4.0 p.m, and twice daily (8 a.m and 11 a.m) for the other groups. Concentrate feed mixture was offered to other groups twice daily at 9.0 a.m. and 4.0 p.m., respectively. Maize silage was offered to the 4th and 5th groups once daily at noon. Water was offered to the buffaloes three times daily.

Two digestion trails were carried out. Each trail consisted of 14 days as a preliminary period and 7 days collection period. During the collection period, feces samples were collected directly from the rectum twice daily. Samples were saved and composted. The first digestibility trial was started before the feeding experiment to determine the digestibility coefficients and nutritive value of maize silage, using 3 buffalo bulls with an average weight of 500 kg. Bulls were offered maize silage *ad libitum* from 08.00 a.m to 04.00 p.m. and the residuals were weighed daily, then the actual feed intake for each bull was calculated. Water was offered three times daily. The obtained feeding values were applied to formulate the experimental rations and to assess the quantities to cover the requirements of the experimental lactating buffaloes.

The second digestibility trial was carried out in the middle of the experimental feeding period to determine the nutritive value of the experimental rations using four dairy buffaloes from each experimental group. Buffaloes were fed according to the normal allowances according to the experimental assignment. Acid insoluble ash (AIA) was used as a natural marker (Van Keulen and Young, 1977).

Chemical analysis of feedstuffs and feces samples were carried out according to the methods of A.O.A.C. (1990).

Morning and evening milk yields were recorded daily and individually and the 7% FCM produced for each buffalo was calculated from daily milk yield and the percentage of milk fat using the formula given by Raafat and Saleh (1962) as follows; 7% FCM = 0.265 milk yield + 10.5 fat yield.

Milk samples from consecutive morning and evening milking were taken weekly during the experimental period, mixed in proportion to yield and analyzed for fat, protein, lactose, solids not fat (SNF) and total solids (TS) by Milko Scan, Model 133B.

Feed efficiency was calculated for the experimental rations as the amount of 7% FCM produced by 1 kg DM, TDN and DCP consumed , while feed conversion was calculated as the amount of DM, TDN and DCP in kg required to produce one kg 7% FCM.

Also, Gine's formulas were applied to calculate the coefficient of efficiency of feed utilization of milk production of energy in terms of TDN.

1. Coefficient of (gross) energetic efficiency =

$$100 \times \frac{\text{TDN in milkk produced}}{\text{TDN in total feeds consumed}}$$

2. Coefficient of (net) energetic efficiency = 100 x

$$\frac{\text{TDN in milkk produced}}{\text{TDN in total feeds consumed above maintenance}}$$

It has been assumed in the present study that one kg of buffaloes milk has 23.5% TDN according to Ministry of Agriculture, A.P.R.I. (1997) and the maintenance requirements were calculated as 35.2 g of TDN/kg$^{0.75}$ of live weight/day (NRC 1988).

Economic efficiency of milk production was expressed as the ratio between the price of daily milk produced and the cost of daily feeds consumed, and was estimated on the basis of the following prices in Egyptian pounds per ton: Buffaloes milk (1400), concentrate feed mixture (600), fresh berseem (50) and maize silage (80).

The data were statistically analyzed using General linear models procedure adapted by SPSS (1997), with one-way ANOVA, means were separated using Duncan's Multiple Range Tests (1955).

RESULTS AND DISCUSSION

Observations concerning silage quality indicated that tested maize silage was free from mold, with suitable fermentation characteristics, yellowish green colour and good smell. The results in Table 1. indicated that pH value of tested silage was 3.8, which seems to be in the normal range of the good quality silages as reported by McDonald *et al.* (1995). Total VFA concentration (Table 2) in tested silage (2.41 mmol/100 ml) indicated acceptable fermentation. The obtained percentage of lactic acid concentration (5.22% of DM) indicated good quality silage as recommended by Chatterjee and Maiti (1981). Accepted value of ammonia-nitrogen concentration (1.45% of total N) in the tested silage was also obtained (Table 2). Langstone (1958) recommended that ammonia-N as percentage of DM for good quality silage should range from 1.02 to 2.87%, also McDonald *et al.* (1995) recommended that NH_3-N% of total-N for good quality silage should be less than 100 g NH_3 - N/kg of total nitrogen. The present results are in agreement with those reported by Bendary *et al.* (2001) for maize silage quality made from some different hybrids and varieties under Egyptian conditions.

Chemical analysis of maize silage (Table 2) indicated that the DM, OM, CP, EE, CF, NFE and ash content were 37.84, 94.31, 8.72, 2.34, 19.22, 64.03 and 5.69%, respectively. These results are in agreement with those 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.

Chemical analysis of feedstuffs and calculated composition of tested rations on DM basis (Table 2) indicated that R_2 and R_3 (containing WB and CFM) contained higher DM, CP, EE and NFE and lower content of CF and ash % compared with feeding wilting berseem as sole diet (R_1). On the other hand, incorporation of maize silage CP, CF and ash % decreased, while EE and NFE% increased in the 4th and 5th rations as compared to wilting berseem alone (R_1). Such results were mainly a reflection of the roughage: concentrate ratio and the

Table (1): Quality characteristics of experimental maize silage.

Item	pH	Lactic acid % of DM	Total VFA's mmol/100 ml	NH_3-N/kg TN g
Maize silage	3.8	5.22	2.41	14.5

* TN = Total nitrogen

Table (2): Chemical analysis of feed ingredients and experimental rations (on DM basis).

Ingredients	DM%	OM	CP	EE	CF	NFE	Ash
CFM	88.59	93.28	18.93	4.58	7.36	62.41	6.72
MS	37.84	94.31	8.72	2.34	19.22	64.03	5.69
WB	24.05	89.05	14.67	1.83	25.51	47.04	10.95
R_1 *	24.05	89.05	14.67	1.83	25.51	47.04	10.95
R_2 *	43.73	90.35	15.97	2.67	19.97	51.74	9.65
R_3 *	54.64	91.05	16.69	3.13	16.91	54.32	8.95
R_4 *	49.04	92.21	13.95	2.86	17.64	57.76	7.79
R_5 *	58.01	91.90	15.95	3.27	15.62	57.06	8.10

* Calculated , CFM: Concentrate feed mixture, MS : Maize silage, WB: Wilting berseem

Table (3): Digestibility coefficients and nutritive values of maize silage and the experimental rations.

Items	Maize silage	Experimental rations				
		R_1	R_2	R_3	R_4	R_5
Digestibility coefficients (%):						
Organic matter (OM)	74.14	63.36^{D}	65.69^{C}	67.04^{C}	71.26^{B}	73.62^{A}
Crude protein (CP)	66.76	57.00^{C}	60.64^{C}	66.11^{B}	68.19^{B}	75.35^{A}
Ether extract (EE)	78.23	47.37^{C}	69.54^{B}	76.24^{AB}	82.56^{A}	77.29^{AB}
Crude fibre (CF)	66.49	52.11^{A}	49.97^{A}	39.11^{B}	46.68^{A}	46.85^{A}
Nitrogen free extract (NFE)	75.24	72.03^{B}	73.14^{B}	74.63^{B}	78.33^{A}	79.94^{A}
Nutritive values as fed (%):						
TDN	26.71	13.71	26.72	34.35	33.37	40.61
DE (kcal/kg DM)*	1177.5	604.45	1178.0	1513.9	1471.4	1790.4
DCP	2.21	2.01	4.22	6.14	4.66	7.01
Nutritive values on DM basis (%):						
TDN	70.58	57.00^{E}	61.10^{D}	62.84^{C}	68.05^{B}	70.00^{A}
DE (kcal/kg DM)*	3111.9	2513.3^{E}	2693.9^{D}	2770.6^{C}	3000.3^{B}	3086.3^{A}
DCP	5.85	8.36^{D}	9.68^{C}	11.05^{B}	9.51^{C}	12.02^{A}
Nutritive ratio**	12.06	1: 6.82	1: 6.3	1: 5.6	1: 7.2	1: 5.8

* DE (kcal/kg DM) = TDN x 4.409 (NRC 1989)

A, B, C, D, E: Means within a raw with different superscripts are differ significantly ($P < 0.01$).

** DCP/TDN ratio.

chemical composition of feed ingredients of the experimental rations (Table 2).

Digestibility coefficients and nutritive values of the tested silage (Table 3.) were relatively high and indicated that maize silage can be consider a suitable and high quality roughage for dairy buffalo as compared to other roughages. The values are within those obtained by Mahmoud *et al.* (1992), Mohamed *et al.* (1999), Elready (2000) and Bendary *et al.* (2001) with Fresian bulls and rams fed maize silage.

The nutritive value of tested maize silage on DM basis as TDN, DE and DCP (Table 3.) were 70.58%, 3111.9 kcal/kg DM and 5.85%, respectively, with wide nutritive ratio (1: 12.06) which might be due to the great values of energy as TDN and the low DCP value. These results are close to those reported by Gaafar (2001).

The average digestibility coefficients of the experimental rations for the different nutrients are shown in Table 3. Results obtained revealed that the lowest digestibility coefficients of OM, CP, EE and NFE were scored by feeding wilting berseem (R_1), while inclusion of MS (R_4 and R_5) led to increase digestibility coefficient values of the previous nutrients. On the other hand, wilting berseem showed the highest digestibility coefficient value for CF.

The highest TDN and DE values (on DM basis) resulted from feeding R_4 and R_5 rations containing MS and WB along with CFM, while R_1 contained WB alone recorded the lowest TDN and DE values with highly significant differences ($P<0.01$) among treatments. On the other hand, feeding R3 and R5 containing high level of CFM showed the highest (11.03 and 12.02%), while feeding WB (R_1) led to the lowest DCP value (8.36%), with highly significant differences among treatments. The present nutritive values mainly related to the chemical composition and proportion of the different feedsuffs (Table 2). That finding was in agreement with the results of Mohamed *et al.* (1998 and 1999) and Elready (2000) using MS, WB and CFM for feeding lactating Friesian cows and buffaloes.

Average milk and 7% FCM yields (Table 4) indicated that the inclusion of CFM and MS improved average milk yield by 18.0, 17.2, 16.0 and 18.0% and by 12.0, 7.2, 14.7 and 17.7% for 7% FCM for group 2, 3, 4 and 5, respectively as compared to the control group fed WB. However, differences between treatments were not significant. These results indicate that the requirements of the expected production for experimental buffaloes in the 2nd, 3rd, 4th and 5th groups were covered by the given formulated rations, while feeding wilting berseem alone was not recover the requirements of the expected production for buffaloes in the 1st group. The present results are in agreement with those obtained by Mahmoud *et al.* (1992) and Elready (2000), who indicated that inclusion of MS 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 (Table 4). The highest fat content was recorded in buffaloes fed R_5 followed by group 1 and 4, while the lowest one was recorded by group 3. This tendency is in agreement with the fact that fat content of milk is in a close relation with dietary CF utilization. According to the present results berseem feeding (R_1) resulted the highest CF content as compared to other groups (Table 2), which indicate the above mentioned relationship. While, the higher fat content of milk produced by the buffaloes fed R_4 and R_5 may be related to the inclusion MS in these rations which generally contained high acetic acid content. The present results are in agreement with Mahmoud *et al.* (1992) who indicated that the inclusion of MS in the rations of lactating Friesian cows significantly increased fat %, also Mohamed *et al.* (1998) indicated that the fat content of buffalo milk increased as effect of feeding maize silage.

Concerning protein content of milk, it can be noticed that buffaloes fed R_1 (wilting berseem alone) had the lowest value of milk protein percentage (4.16%) while those fed R_4 ration achieved the highest values followed by R_5, meantime: R_2 and R_3 containing WB and CFM recorded intermediate values. These observations seem to be confirmed with the energy intake. Bachman (1992) indicated that as the energy intake increased from carbohydrate sources the milk yield and protein percentage also increased. During this experiment when the energy consumption increased in R_4 and R_5, the protein content of milk also increased. Great variation in milk lactose, solids not fat and total solids contents were noticed and the differences between groups were highly significant ($P < 0.01$) as it is shown in Table 4. The present results of lactose, SNF and TS are within the normal range as obtained by several authors (El-Ashry *et al.*, 1996 and Mohamed *et al.*, 1998) for buffalo milk.

Results of daily feed consumption (Table 5) indicated that buffaloes fed R_3 and R_5 consumed lower DM, expressed as kg/head/day or g/kg $W^{0.75}$ as compared to the other groups. Meantime, the buffaloes fed R_4 consumed daily the highest TDN expressed as kg/head/day or g/kg $W^{0.75}$ followed by R_5 group as compared to the other groups, while buffaloes fed berseem alone (R_1) consumed lowest DCP as kg/head/day or g/kg $W^{0.75}$ as compared to feeding other tested rations.

The feed efficiency expressed as the amount of 7% FCM produced by one kg DM, TDN and DCP consumed are presented in Table 5. It could be observed that WB and FCM feeding with or without MS improve the feed efficiency as compared to feeding WB alone (R_1). The differences among all tested groups were not significant ($P > 0.05$).

The efficiency of utilizing the combination of maize silage and concentrate feed mixture was observed in this study which is in agreement with that obtained by Mahmoud *et al.* (1992) and Elready (2000) who found that lactating Friesian cows fed maize silage along with concentrate feed mixture were more efficient concerning the amount of 4% FCM produced by one kg DM, TDN consumed, if compared with feeding berseem and concentrate feed mixture.

Meanwhile, the lower values obtained for protein utilization for buffaloes fed rations 3 and 5 were mainly due to the high DCP intake (1.64 and 1.61 kg/day) than their requirements (Table 5).

Concerning feed conversion R_5 resulted the best feed conversion as kg of DM consumed/kg 7% FCM produced followed by R_4, while the control (R_1) showed the lowest one. Meanwhile, all tested groups showed nearly similar feed conversion as the amount required from TDN and DCP to produce 1 kg 7% FCM. The differences were not statistically significant among treatments.

Also, results of gross and net energy efficiency were improved with incorporation of concentrate feed mixture (R_2 and R_3) and maize silage (R_5) as compared to feeding wilted berrseem alone (R_1).

The results obtained herein are in agreement with those of Bendary and Younis (1997) and Elready (2000) who found a tendency towards better feed conversion as the amount required from TDN to produce 7% FCM with feeding lactating cows maize silage.

Table 4: Milk production and its components of lactating buffaloes fed the experimental rations

Items	Experimental rations				
	R_1	R_2	R_3	R_4	R_5
Av. daily milk yield kg	8.9	10.5	10.16	10.32	10.5
Av. daily 7% FCM* yield kg	9.28	10.39	9.95	10.64	10.89
Milk fat %	7.35 ^{a}	6.92 ^{b}	6.83 ^{b}	7.30 ^{ab}	7.40 ^{a}
Milk protein %	4.16 ^{B}	4.35 ^{AB}	4.49 ^{A}	4.60 ^{A}	4.51 ^{A}
Milk lactose %	4.87 ^{D}	4.97 ^{CD}	5.05 ^{BC}	4.99 ^{A}	5.13 ^{AB}
Milk SNF %	9.29 ^{C}	9.62 ^{B}	9.74 ^{B}	10.10 ^{A}	9.91 ^{AB}
Milk TS %	16.64 ^{B}	16.54 ^{B}	16.57 ^{B}	17.40 ^{A}	17.31 ^{A}

a, b: Means within a raw with different superscripts differ significantly ($P < 0.05$).
A, B, C Means within a raw with different superscripts differ significantly ($P < 0.01$).
*** 7% FCM = 0.265 milk yield + 10.5 fat yield (Raafat and Saleh, 1962).**

Table (5): Average daily feed intake, feed efficiency and economic efficiency as affected by feeding the tested rations.

Items	Experimental rations				
	R_1	R_2	R_3	R_4	R_5
Average daily feed intake (kg/head/day) as fed					
Concentrate feed mixture (CFM)	-	5.00	7.35	5.00	7.50
Wilting berseem (WB)*	60.5	42.0	30.00	20.00	20.0
Maize silage (MS)	-	-	-	13.00	5.00
Total	60.5	47.00	37.35	38.00	32.5
Average daily feed intake (kg/head/day) on DM basis					
Concentrate feed mixture (CFM)	-	4.43	6.51	4.43	6.64
Wilting berseem (WB)	14.55	10.10	7.22	4.81	4.85
Maize silage (MS)	-	-	-	4.92	1.89
DM I kg/h/d	14.55	14.53	13.73	14.16	13.38
DM I gm/kg$^{0.75}$	132.66^{A}	120.60^{BC}	110.04^{CD}	125.03^{AB}	110.37^{D}
TDN I kg/h/d	8.27	8.91	8.63	9.64	9.37
TDN I gm/kg$^{0.75}$	75.70^{BC}	73.66^{BC}	71.81^{C}	85.06^{A}	77.29^{B}
DCP I kg/h/d	1.21	1.40	1.51	1.35	1.61
DCP I gm/kg$^{0.75}$	11.03^{C}	11.63^{C}	13.53^{AB}	11.89^{BC}	13.28^{A}
Feed efficiency					
Kg 7% FCM/1 kg DM intake	0.64	0.72	0.72	0.75	0.81
Kg 7% FCM/1 kg TDN intake	1.12	1.17	1.15	1.10	1.16
Kg 7% FCM/1 kg DCP intake	7.6	7.37	6.59	7.88	6.76
Cross efficiency of energy	26.36	27.72	27.69	25.21	26.36
Net efficiency of energy	49.43	53.23	54.82	42.04	48.43
Feed conversion					
Kg DM intake/1 kg 7% FCM	1.67	1.40	1.38	1.33	1.23
Kg TDN intake/1 kg 7% FCM	0.95	0.86	0.87	0.91	0.86
Kg DCP intake/1 kg 7% FCM	0.14	0.14	0.15	0.13	0.15
Input costs (L.E)[1]	3.03	5.10	5.91	5.04	5.9
Output (L.E)[2]	12.95	14.54	13.92	14.90	15.24
Economic efficiency[3]	4.28 ^{A}	2.85 ^{B}	2.36 ^{B}	2.76 ^{B}	2.58 ^{B}
Feed cost/1 kg 7 FCM (PT)	34.98 ^{b}	50.28 ^{ab}	54.88 ^{ab}	49.44 ^{ab}	54.63 ^{a}

*** Wilting for 1-2 days before feeding.**
a, b, Means within a raw with different superscripts differ significant ($P < 0.05$).
A, B, C, D: Means within a raw with different superscripts differ significant ($P < 0.01$).
1. Price of feeds consumed/day (L.E). Price of milk produced/day (L.E.).
Economic efficiency = [price of milk produced per day (L.E.)]/costs of daily feed intake (L.E.)

The economic efficiency calculated as price of the daily milk produced/costs of daily feed portion (Table 5) showed that the highest economic efficiency was recorded for R_1 which contained berseem only, while the other tested rations (2, 3, 4 and 5) recorded nearly similar value.

The present results are in agreement with Mahmoud *et al.* (1992) who found that cows fed fresh berseem were the best milk producers from economic point of view as compared to those fed corn silage along with concentrate feed mixture.

The results of this study cleared that berseem in spite of its narrow energy/protein ratio is still the cheapest and most suitable winter forage in some areas in Egypt which produced surplus quantities of berseem, but it can be fed along with concentrate or maize silage for dairy cattle to improve their production.

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تأثير استخدام سيلاج الذرة مع البرسيم على الأداء الإنتاجي للجاموس الحلاب

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أجرى هذا البحث بهدف دراسة أداء الجاموس الحلاب عند تغذيتها على سيلاج الذرة والعلف المركز مع البرسيم شتاء. استخدم فى هذه الدراسة ٢٥ جاموسه حلابة ما بين الموسم الثانى وحتى الموسم الخامس ابتداء من الأسبوع السادس من بداية الحليب وبأوزان تتراوح بين ٥٠٠ و ٦٠٠ كيلو جرام حيث قسمت إلى ٥ مجموعات (٥ جاموسات بكل مجموعة) غذيت لمدة ١٢٠ يوم على علائق تحتوى على البرسيم المدبل لمده ١ أو ٢ يوم حسب الظروف الجوية مع نسب مختلفة من العلف المركز وسيلاج الذرة على أساس المادة الجافة كالتالى:

- العليقة الأولى كانت على البرسيم فقط حتى الشبع.
- الثانية: ٦٩,٥% برسيم + ٣٠,٥% علف مركز.
- الثالثة: ٥٢,٦% برسيم + ٤٧,٤% علف مركز.
- الرابعة: ٣٤% برسيم + ٣١,٣% علف مركز + ٣٤,٧% سيلاج أذره.
- الخامسة: ٣٦,٣% برسيم + ٤٩,٦% علف مركز + ١٤,١% سيلاج الذرة.

وقد أظهرت النتائج ما يلى

احتوى سيلاج الذرة (على أساس المادة الجافة) على ٩٤,٣١% مادة عضوية ، ٨,٧٢% بروتين خام ، ٣٤% مستخلص الأثير ، ١٩,٢٢% ألياف خام ، ٦٤,٠٣% مستخلص خالى من الأزوت ، ٥,٦٩ % رماد. وكانت درجة حموضة السيلاج المنتج وتركيز حامض اللاكتيك والأحماض الدهنية الحرة والأمونيا فى الحدود الطبيعية للسيلاج الجيد. وقد كان محتواه عاليا من مجموع المركبات الغذائية المهضومة والطاقة المهضومة (٧٠,٥٨ % ، ٣١١١,٩ كيلو كالورى/كجم مادة جافة على التوالى) وأقل من البروتين المهضوم (٥,٨٥%).

أدى استخدام العلف المركز وسيلاج الذرة مع البرسيم (المجموعة الرابعة والخامسة) إلى زيادة معنوية فى محتواها من المركبات الغذائية المهضومة والطاقة المهضومة. بينما سجلت المجموعة التى غذيت على البرسيم حتى الشبع (الأولى) على أقل القيم. وقد أدى استخدام العلف المركز إلى زيادة محتوى العليقة الثالثة والخامسة من البروتين المهضوم.

أدى استخدام العلف المركز وسيلاج الذرة إلى زيادة فى متوسط إنتاج اللبن اليومى بمقدار ١٧,٩٨ ، ١٧,١٦ ، ١٥,٩٦ ، ١٧,٩٨% وزيادة فى المتوسط اليومى لإنتاج اللبن المعدل ٧% دهن بمقدار ١١,٩٦ ، ٧,٢٢ ، ١٤,٦٦ ، ١٧,٧٣% للمجاميع الثانية والثالثة والرابعة والخامسة على التوالى مقارنة بالتغذية على البرسيم فقط.

كانت الاختلافات معنوية بين المجموعات فى نسبة الدهن والبروتين واللاكتوز والمواد الصلبة اللادهنية والمواد الصلبة الكلية. لم تكن هناك فروق معنوية لكل من الكفاءة الغذائية والكفاءة التحويلية للجاموس عند تغذيتها على العلائق المختبرة.

كانت العليقة المحتوية على البرسيم فقط (المجموعة الأولى) الأفضل من الناحية الاقتصادية مقارنة بالعلائق الأخرى. قدرت تكاليف التغذية لإنتاج واحد كيلو جرام لبن معدل ٧% دهن بمقدار ٣٤,٩٨ ، ٥٠,٣٨ ، ٥٤,٨٨ ، ٥٩,٤٤ ، ٥٤,٦٣ قرش فى المجموعات الأولى والثانية والثالثة والرابعة والخامسة التوالى.