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CONSERVATION OF GREEN SUMMER FORAGES AS SILAGE AND ITS UTILIZATION IN FEEDING GROWING LAMBS

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SUMMARY

Six pilot bunker silos in lsmailia Agricultural Research Station belonging to Agricultural Research Center, Egypt were used to ensile six green forages namely: whole crop maize; green corn stovers plus 2% molasses; green corn stovers; sorghum forage; millet/ darawa mixture (4:1) and cowpea/darawa mixture (4:1) plus 2% molasses.

Six digestibility trials using 18 local bred rams (three in each trial) were conducted to evaluate the digestibility coefficients and feeding values of the obtained silages. Forty rams in two feeding trials were fed the produced silages (three silages in each trial) free choice and a concentrate mixture at a rate of 1.5% of live body weight (L.B.W.) compared to two control rations of wheat straw or dried corn stover and the same concentrate mixture at the same rate. Eight digestion trials were also carried out during the feeding periods to evaluate the feeding value of the experimental rations.

Dry matter losses were determined and the silage quality was evaluated by determination of pH, ammoniacal nitrogen and organic acids which indicated that all the produced silages were of good quality.

Whole crop maize and green maize stovers were the most efficient in DM preservation (85.55 and 84.81%, respectively) while it ranged in the other silages between 77.48 and 80.42%. Addition of molasses tended to

decrease DM preservat green maize stovers through more seepage.

Digestibility coefficients of whole crop maize recorded the highest values and Sorghum silage showed the lowest figures. Addition of molasses tended to increase the digestibility coefficients and feeding values as TDN, SV and DCP of green maize stovers and cowpea/darawa mixture.

Lambs fed whole crop maize silage and cowpea/darawa plus 2% molasses consumed the largest DM,SV and DCP as well as they produced significantly ($P < 0.05$) higher average daily weight gain (112.5 and 204.1 g/head/day, respectively) and better efficiency of feed utilization (3.671 and 2.690 Kg SV/Kg gain) than lambs fed other rations.

Keywords: Silage, Summer forages, growth, lambs

INTRODUCTION

The shortage of animal feeds and their improper distribution between summer and winter seasons are the main obstacle which stands in animal production development. As a solution to this problem,many scientists suggested cultivation of high producing forages and conservation of the surplus as hay and silage to be fed when they are in short (Hathout, 1966, Makky and EL-Nouby, 1966; Makky, 1976; Abdel-Malik; 1972 and Gabra et al. 1990).

Silage is succulant feed and if ensiled well, it can be relished by all livestock. However, the nutritive value of silage is affected by the nature of the crop ensiled and type of fermentation occurring within the mass and degree of effluent produced (McDonald et al., 1979).

Some feedstuffs could be used as additives for better preservation (molasses, ground grains, corn and cobs), farm by -products as conditioners, such as straws, corn stovers and dry by- products) and physical treatment (wilting and chopping) are the simplest methods to improve silage quality to be adopted by local farmers.

The objectives of these trials were to find the suitable method for conserving some Summer forages to be fed during the period of green forage shortage at summer. Silage quality, feeding value, productive

performance and feed utilization by growing lambs were also investigated.

MATERIALS AND METHODS

This study was carried out at Ismailia Agricultural Research station during Summer and Autum of 1992 and Winter of 1993.

Six summer forages were ensiled in six pilot bunker silos (2 x 3 x 1.5 m each). All forages were chopped and left to wilt for 8 hrs. before ensiling in the assigned silos. The forages and method of ensiling were as follows:

[a] Whole green crop maize (dough stage).
[b] Green maize stover plus 2% molasses.
[c] Green maize stover (after ears harvesting).
[d] Sorghum forage.
[e] Millet plus darawa (green maize, milk stage, 4:1)
[f] Cowpea plus darawa (4:1) + 2% molasses.

Each bunker was filled by the assigned forage or forages, pressed and covered by plastic sheet and a layer of sand and stones on top. Records were kept for amounts of forages ensiled and silage taken out. After three months from ensiled forages, samples of silage produced were taken periodically to evaluation

Six digestibility trials were carried out using 18 rams (three rams in each trial) to determine the digestibility coefficients and feeding values of the obtained silages. The rams were individually placed into metabolism cages made of stainless steel. Each digestibility trial lasted for 17 days, the first ten days were preliminary period followed by seven days as collection period. Silages were offered ad. lib. twice daily and water was allowed freely. Feeds and faeces were weighed, sampled, dried and analyzed according to A.O.A.C. (1980).

Two feeding trials were conducted to evaluate the productive performances of lambs fed ad. lib. the produced silages (3 silages in each trial) along with a concentrate mixture at 1.5% of live body weight (L.B.W.) compared to a control ration consisting of wheat straw or chopped dried corn stover in the 1st and 2nd feeding trial respectively and also concentrate mixture at the rate of 1.5% of L.B.W.

Eight digestibility trials were conducted during the

feeding experiments to determine the feeding value of the eight rations (silage + concentrate mixture) fed to lambs. Body weights of animals were recorded weekly and consumed feeds were recorded daily.

Representative samples from silage were taken to determine the chemical composition and silage quality (pH, ammoniacal -N and lactic acid) according to A.O.A.C. procedures. Volatile fatty acids (VFA'S) were analyzed according to the procedure of Ottenstein and Bartley (1971 a & b) using Perkin Elmmer GLC (Model 3920-B).

Results were statistically analyzed according to Snedecor and Cochran (1982) and the statistical differences among means were tested by Duncan's Multiple Range test (1955).

RESULTS AND DISCUSSION

Average chemical composition of the forages as stored is presented in Table (1). Chemical characteristics of the stored forages were very similar, with the exception of a higher DM content of the whole crop maize and green maize stovers than the other forages.Green maize stovers had the lowest figures for CP while cowpea plus Darawa (4:1) showed the highest figure.

Table 1. Average chemical composition of forages as stored

Nutrients	Whole crop maize	Green maize stovers+2% molasses	Green maize stovers	Sorghum forage	Millet+ Darawa (4:1)	Cowpea + Darawa (4:1)+2% Molasses
Dry Matter%	31.45	31.45	30.86	19.75	19.12	20.42
Composition of DM %	11.12	6.88	6.74	10.10	9.55	16.29
CP	2.14	2.61	2.65	2.87	2.80	2.86
EE	30.16	32.84	33.48	33.22	33.77	26.67
CF	41.82	43.38	42.82	42.69	41.73	39.78
NFE	14.76	14.29	14.31	11.12	12.15	14.40
Ash						

Average chemical composition of the silages produced for feeding is presented in Table (2). The higher DM content of the whole crop maize and green maize stovers persisted through the storage period and all the silages

produced showed higher DM content than that of the forages as stored. This increase was an expected result due to the loss of moisture through seepage. The DM, CP and ash contents of whole crop maize silage found in this experiment were higher than those reported by Thomas (1979). This might be due to ensilage of different varieties of forages.

Table 2. Average chemical composition of silages as fed

Items	Whole crop maize	Green maize stover, +2% molasses	Green maize stovers	Sorghum forase	Millet + Darawa (4:1)	Cowpea+ Darawa (4:1)+2% Molasses
Dry matter%	32.52	31.48	34.33	20.08	20.52	22.07
Composition of DM%						
CP	12.13	10.43	9.36	11.90	10.14	9.64
EE	3.11	2.45	2.40	3.12	3.32	2.65
CF	31.49	34.91	36.29	26.40	30.02	30.83
NFE	44.23	39.89	39.66	47.94	46.68	48.73
Ash	9.04	12.32	12.29	10.64	9.84	8.15
pH	4.24	4.67	4.91	4.39	4.66	4.72
Ammoniacal-N%	0.22	0.27	0.24	0.23	0.27	0.28
Acetic acid%	2.84	2.62	2.30	1.28	2.75	2.57
Propionic acid%	0.48	0.28	0.24	0.28	0.23	0.24
Butyric acid%	0.22	0.20	0.44	0.63	0.65	0.24
Lactic acid%	8.19	5.39	7.19	7.16	5.39	6.21
Total VFA's%	3.54	3.10	2.98	2.19	3.63	3.05

Protein degradation as indicated by ammoniacal nitrogen values were quite well controlled in all silages, although it tended to be higher in cowpea and darawa mixture plus 2% molasses.

All silages showed lower ash content than that of their forages as stored which were mainly due to loss through seepage.

Organic acids and pH values indicated that all the produced silages were of good quality. However, somewhat greater amounts of butyric acid were observed in the silages of green maize stovers without molasses, Sorghum and the mixture of Millet and Darawa than that in the other silages, but they, however, had pleasant odor. Addition of molasses tended to give silages of better chemical quality. Such results were obtained by

Vanhatalo et al. (1992) and Aronen and Vanhatalo (1992)

Forage DM was most efficiently preserved with whole crop maize (85.55%) and that of green maize stovers without addition (84.81%). The efficiency of DM preservation of the other silages were practically equal since it ranged between 77.48 and 80.42% (Table 3). The lower DM value of green maize stovers with molasses than that without molasses might be due to higher seepage loss in the former than that of the later. Crude protein tended to be well preserved in most of the silages except that of cowpea-Darawa mixture with molasses which might be attributed to its higher initial CP content and/or to higher seepage losses.

Table 3. Percentage recovery of nutrients after ensilage

Nutrients	Whole crop maize	Green maize stovers +2% molasses	Green maize stovers	Sorghum forage	Millet + Darawa (4:1)	Cowpea + Darawa (4:1) +2% molasses
Drymatter%	85.55	77.89	84.81	77.48	80.42	78.07
Crude protein%	89.67	95.34	97.69	88.99	78.99	42.75
Ether extract%	119.47	73.04	69.05	82.84	88.21	66.93
Crude fiber%	85.83	82.72	82.64	60.56	66.13	83.50
N.F.E.%	88.91	75.14	70.61	85.76	88.56	88.49
Ash%	50.35	77.81	65.48	72.91	41.88	40.88

Digestibility coefficients and feeding values of the experimental silages are presented in Table (4). It could be noticed that the digestibility coefficients of all nutrients of sorghum silage were significantly ($P<0.05$) lower than most of the other silages, while those of whole crop maize silage tended to record the highest values. Addition of molasses to green maize stovers tended to increase the digestion coefficients, especially CP than that without molasses addition, which was reflected on its feeding value as TDN, SV and DCP. The OM digestibility of whole crop maize reported in this study was higher than reported by Thomas (1979), Sheldrick (1975), Phipps (1975) and Carrall et al. (1977).

The feeding value of whole crop maize silage showed the highest values followed by silages of cowpea-Darawa mixture plus 2% molasses and Millet-Darawa mixture,

while those of green maize stovers silage without molasses addition recorded the lowest values. Addition of 2% molasses to green maize stovers significantly increased its feeding value as TDN, SV and DCP than that without molasses addition. However, the results of the feeding values of maize stovers were slightly lower than those reported by Abd-EL-Baki et al. (1989) with silages made from stovers of two maize varieties (Giza-2 and Hybrid 204) which might be due to variety differences and/or higher temperature of the mass in this study due to more air entrapped which can badly affect the digestion coefficients of the nutrients, especially CP digestibility.

Table 4. Digestibility coefficients and feeding value of the obtained silages

Item	Whole crop maize	Green maize stovers +2% molases	Green maize stovers	Sorghum forage	Millet+ Darawa (4:1)	Cowpea+ Darawa (4:1) +2% molasses
Digestibility Coefficients, %						
DM	66.6a	66.3a	63.1a	55.1b	62.7a	65.8a
OM	68.4a	68.6a	66.2a	58.0b	65.4a	67.6a
CP	64.9a	58.3a	50.7b	52.4b	57.0a	57.5a
EE	76.3a	71.9a	68.2a	63.8b	69.9a	63.3b
CF	70.6a	74.5a	69.6a	52.5b	66.2a	69.1a
NFE	68.6a	66.1a	66.9a	63.5b	66.3a	68.8a
Nutritive value(%)						
TDN	65.9a	62.4a	58.7b	58.8b	63.8	64.2a
SV	46.4a	41.2b	38.8c	42.5b	45.3a	45.4a
DCP	7.87a	6.08a	4.75b	6.23a	5.78a	5.54ab
Nutritive ratio	7.37	9.26	11.37	8.44	10.04	10.58

a and b: Means followed by different letters in the same column are significantly ($P<005$) different

The feeding values of the tested rations in the two feeding experiments compared to control rations are illustrated in Table (5). It could be seen that the feeding values as TDN and SV of whole crop maize ration (silage ad. lib. plus 1.5% of L.B.W. concentrate mixture) in 1st experiment and cowpea/Darawa mixture

plus 2% molasses ration in 2nd experiment recorded significantly (P< 0.05) the highest figures. Green maize stovers with or without molasses rations of 1st experiment and sorghum silage and Millet-Darawa rations in 2nd Experiment recorded slightly lower feeding values. The control rations in both experiments recorded also the lowest values of DCP.

Table 5. Feeding values of the experimental rations

Experimental rations	Feeding value, % as		
	TDN	SV	DCP
Firat experiment:			
Whole crop maize +Concentrates	68.1a	55.0a	7.5a
Green maize stovers +2% molasses +concentsates	63.3b	48.9b	7.3a
Green maize stovers +concentrates	64.9b	50.4b	7.0a
Wheat straw +concentrates (control ration)	56.6c	42.6c	3.8b
Second experiment:			
Sorghum forage +concentrates	53.8a	45.1b	5.9b
Millet +Darawa (4:1) +concentrates	54.4a	44.5b	6.2b
Cowpea +Darawa (4:1) +2% molasses + concentrates	58.6a	47.3a	8.6a
Dried corn stovers +concentrates (control ration)	49.2b	36.3c	2.6c

a,b and c: Means followed by different letters in the same column are significantly (P<005) different

Results of the two feeding trials are presented in Tables (6) and (7). In the 1st trial, lambs fed the whole crop maize ration consumed the most forage and concentrate as DM, TDN, SV and DCP and produced significantly higher average daily wight gain and better efficiency of feed utilization (TDN, SV and DCP/kg gain) than either the tested other two rations or the control ration. Similar effects have been recorded in terms of intake with cattle (Beattle et al., 1971).

No significant differences existed between the green maize stovers with or without molasses addition. However, addition of molasses tended to increase DM, SV and DCP consumption and produced better average daily weight gain and efficiency of feed utilization than that without molasses addition.

Table 6. Performance of lambs fed different silage rations with concentrate during 1st feeding trial

Item	Whole crop maize	Greem maize stovers +2% molases	Green maize stavers	Control ration*
No of animals	5	5	5	5
Duration of the experiment (day)	56	56	56	56
Av. Initial L.B.W.(kg)	20.12	20.08	20.04	20.08
Av. Final L.B.W.(kg)	26.42	24.44	23.66	23.00
Total gain (kg)	6.30a	4.36b	3.62bc	2.92c
Av. daily weight gein(gm)	112.5a	77.9b	64.6bc	52.1c
Av. feed DM consumed (kg/lamb/day):				
Silage (or wheat stsaw)	0.435	0.404	0.377	0.296
Concentrate mixture	0.315	0.302	0.297	0.293
Total DM	0.750	0.706	0.674	0.589
AV. faeding value of feeds consumed as:				
TDN (kg/day/Lamb)	0.511	0.447	0.437	0.333
SV (kg/day/Lamb)	0.413	0.345	0.340	0.251
DCP (g/day/Lamb)	56.3	51.5	47.2	22.4
AV. efficiency of feed utilization:				
kg DM /kg gain	6.667	9.063	10.433	11.305
kg TDN/kg gain	4.542b	5.738a	6.765a	6.392a
kg SV /kg gain	3.671b	4.429a	5.263a	4.818a
kg DCP/kg gain	0.500b	0.661a	0.731a	0.499b
feed cost /kg LBW gaim (LE)	5.907	3.166	3.148	2.812
Economical effciency	1.101	2.053	2.065	2.312

* Control ration consisted of wheat straw +1.5% of L.B.W concentsate mixture
a and b: Means followed by different lette in the same raw are significwtly ($P<0.05$)differed

In the 2nd trial, lambs fed cowpea-darawa plus 2% molasses ration (Silage ad. lib.+ 1.5% of L.B.W. concentrate mixture) consumed the most forage and concentrate as DM, TDN, SV and DCP and produced significantly ($P<0.05$) higher average daily weight gain and better efficiency of feed utilization (TDN, SV/kg gain) than either the two tested silage rations or the control ration. However, the control ration was significantly better than all tested rations.

Concerning the average efficiency of feed utilization as DCP, the generally higher consumption of cowpea/ Darawa plus 2% molasses ration might be due to the silage having higher legume content and consequently higher DCP than the other tested silage which was reflected on better lamb

performance as recorded by Ritta sormunen (1992) and Heilkkila et al. (1992). Data showed also that the control rations in both 1st and 2nd feeding trials were cheaper than the others, indicating higher economical efficiency and lower feed cost.

Table 7. Performance of lambs fed different silage rations with concentrate during 2nd feeding trial

Item	Sorghum forage	Millet + Darawa (4:1)	Covpea + Darawa (4:1) + 2% molasses	Control ration*
No of animals	5	5	5	5
Duration of the experiment (day)	49	49	49	49
AV. Initial L.B.W. (kg)	23.20	23.18	23.22	23.20
AV. Final L.B.W. (kg)	28.29	28.76	33.22	28.50
AV. Total gain (kg)	5.59b	5.58b	10.00a	5.30b
AV. daily weight gain (g)	103.9 b	113.9 b	204.1 a	108.2 b
AV. Feed DM Consumed (kg/Lamb/day):				
Silage (or dried chopped corn stavers)	0.454	0.558	0.780	0.463
Concentrate mixture	0.338	0.352	0.381	0.350
Total DM consumed	0.792	0.910	1.161	0.813
AV. Feeding value of feeds consumed as:				
TDN (kg/Lamb/day)	0.426	0.495	0.680	0.400
SV (kg/Lamb/day)	0.357	0.405	0.549	0.295
DCP (g /Lamb/day)	46.7	56.4	99.9	21.1
AV. efficiency of feed mitilization as :				
kg DM /kg gain	7.623	7.990	5.688	7.514
kg TDN/kg gain	4.100a	4.346a	3.332b	3.697b
kg SV /kg gain	3.436a	3.556a	2.690b	1.726b
kg DCP/kg gain	0.450a	0.452a	0.495a	0.195b
Feed cost/kg L.B.W. gain (L.E.)	2.352	2.392	1.766	1.737
Economical efficiency	2.764	2.717	3.681	3.741

* Control ration consisted of dried chapped corn stovers + 1.5% of L.B.W. concentrate mixture
a and b: Means followed by differet letters in the same raw are significantly ($P < 0.05$) differed.

This may be attributed to lower energy and protein intakes. However, ration containing green maize stover silage in 1st trial and cowpea/darawa mixture plus 2% molasses silage in

2nd trial appeared achieve to the best figures for feed cost/kg gain (3.148 and 1.766 L.E., respectively) and economical efficiency (2.065 and 3.681 L.E., respectively) This was due to higher daily gain for animals fed those rations.

The averages of daily weight gain in 2nd experiment were generally higher than those of 1st experiment. This might be due to higher palatability of the rations fed, higher initial live body weight and higher DM intake.

It could be concluded that conserving the whole crop maize and cowpea/Darawa plus 2% molasses gave the best results concerning DM consumption, daily weight gain and feed efficiency. Addition of molasses to green maize stovers increases its feeding value which approaches that of sorghum silage and thus recommended. Further studies are needed to determine the effect of adding different percentages of molasses and other additives on the feeding value of the produced silages, DM losses, chemical quality and performance of animals.

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حفظ الاعلاف الخضراء الصيفية كسيلاج والاستفادة منه فى التغذية الحملان النامية

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اجريت ستة تجارب هضم (باستخدام ثلاثة حملان فى كل تجربة) على ستة انواع مختلفة من السيلاج المصنع من الاعلاف الخضراء صيفية وباستخدام اضافات او بدون اضافات لتقدير القيمة الغذائية والهضمية للسيلاج الناتج وهى:
١- سيلاج نبات الاذرة بالكيزان ،٢- سيلاج حطب اذرة اخضر + ٢٪ مولاس، ٣- سيلاج حطب اخضر بدون اضافات، ٤- سيلاج سورجم، ٥- سيلاج ميليت + دراوة (٤:١)، ٦- سيلاج لوبيا علف + دراوة (٤:١) + ٢٪ مولاس.
كما اجريت تجربتى تغذية على الحملان، كل تجربة تحتوى على اربعة مجموعات غذائية (٥ حملان فى كل مجموعة) كما يلى :
التجربة الاولى :
المجموعة الاولى : سيلاج نبات الاذرة بالكيزان حتى الشبع + ١,٥ ٪ علف مركز. المجموعة الثانية : سيلاج (حطب اذرة اخضر + ٢٪ مولاس)حتى الشبع + ١,٥ ٪ علف مركز. المجموعة الثالثة : سيلاج (حطب اذرة اخضر بدون اضافات)حتى الشبع + ١,٥ ٪ علف مركز. المجموعة الرابعة: قش ارز حتى الشبع + ١,٥ ٪ علف مركز (مقارنة)
التجربة الثانية :
المجموعة الاولى : سيلاج سورجم حتى الشبع + ١,٥ ٪ علف مركز. المجموعة الثانية : سيلاج (ميليت + دراوة ، ٤:١)حتى الشبع + ١,٥ ٪ علف مركز. المجموعة الثالثة : سيلاج (لوبيا علف + دراوة ، (٤:١)+ ٢٪ مولاس) حتى الشبع + ١,٥ ٪ علف مركز. المجموعة الرابعة : حطب اذرة جاف حتى الشبع + ١,٥ ٪ علف مركز (مقارنة)

وقد اوضحت النتائج ما يلى :-

١- كان السيلاج الناتج من الاعلاف الخضراء المختبرة جيدا من حيث محتواه من الاحماض العضوية وتركيز ايوان الايدروجين٠

٢- افضل انواع السيلاج من حيث حفظ المادة الجافة كان السيلاج المصنع من نبات الاذرة بالكيزان وحطب الاذرة الاخضراء حيث بلغت نسبة المادة الجافة المحفوظة ٨٥,٥٥ ، ٨٤,٨١ ٪ على التوالى ، بينما تراوحت فى الانواع الاخرى ما بين ٧٧,٤٨ الى ٨٠,٤٢ ٪ وقد ادى اضافة المولاس الى خفض المادة الجافة المحفوظة فى سيلاج حطب الاذرة الاخضر نتيجة لزيادة الفقد فى العصير ٠

٣- سجلت معاملات الهضم للسيلاج المصنع من نبات الاذرة بالكيزان اعلى قيم بينما سجل السيلاج المصنع من السورج اقل قيم لمعاملات الهضم ، وقد ادى اضافة المولاس الى زيادة معاملات الهضم والقيمة الغذائية لسيلاج حطب الاذرة ولوبيا العلف مع الدراوة٠

٤- سجلت الحملان التى تغذت على العلائق المحتوية على السيلاج نبات الاذرة بالكيزان وسيلاج لوبيا العلف مع الدراوة + ٢٪ مولاس اعلى معدل نمو يومى(١١٢,٥ ، ٢٠٤,١ كجرام / راس / يوم على التوالى) كما انها عطيت افضل كفاءة غذائية (٣,٦٧١، ٢,٦٩٠ كجم معادل نشا / كجم نمو على التوالى) وذلك بالمقارنة بالمجموعات الاخرى ٠

من النتائج السابقة يتضح ان التغذية على السيلاج المصنع من نبات الاذرة بالكيزان والسيلاج المصنع من الوبيا العلف مع الدراوة + ٢٪ مولاس سجلت افضل قيم بخصوص المادة الجافة المأكولة وزيادة الوزن اليومى للحيوان وكذلك الكفاءة الغذئية ، كما ان اضافة المولاس عند تصنيع السيلاج من حطب الاذرة قد ادى الى زيادة قميته الغذائية ٠

كما يتضح من النتائج السابقة الاحتياج الى دراسات اخرى لدراسة تأثير اضافة نسب مختلفة من المولاس مع اضافات اخرى على القيمة الغذائية للسيلاج الناتج وصفاته الطبيعية والكمياوية واداء الحيوان عند التغذية عليه٠