GROWTH AND NUTRIENT UTILIZATION IN OSSIMI LAMBS FED ON COWPEA SILAGE (*Vigna unguiculata*) OR WHOLE CROP CORN SILAGE

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(Received, April 22, 2003)

ABSTRACT

The feasibility of using cowpea as summer legume to cover the great shortage in animal feedstuffs particularly during summer season was determined in comparison with corn as a common summer crop. This study was conducted on 12 Ossimi lambs in Ismailia Agricultural Research Station, Ismailia province. Animals were divided into two similar groups, whole crop corn silage and cowpea silage. The two experimental groups were supplemented with concentrate feed mixture at level 1% of live body weight. The chemical composition showed that crude protein content was higher (16.11% Vs 9.17%) and crude fiber content was lower (24.52% Vs 34.86%) in cowpea than whole crop corn. Silage quality of the two different materials indicated that whole crop corn and cowpea (with 5% molasses) produced good quality silage.

Results of The nutritive value on dry matter basis, as TDN (59.78 Vs 62.3 for cowpea and corn silage) was not significantly different. But, the respective SV values were 44.21 Vs 41.44 and DCP 9.89 Vs 5.7 were significantly ($P<0.05$) higher with cowpea than whole crop corn silage. There was no significant difference regarding total body gain between lamb groups fed whole crop corn or cowpea silage. Therefore, it is noteworthy to indicate that cowpea can be used as an alternative feed source for finishing lambs during the summer months. It has outstanding potential for intercropping with various other crops such as maize to reach the potential production in protein and energy sources.

Keywords: Cowpea silage - whole corn silage - protein content - sheep - Digestibility - live body gain

INTRODUCTION

In Egypt, there is a great shortage in animal feedstuffs particularly during summer season. Many attempts were made to introduce some forages which suit the Egyptian weather and soil conditions. Among these forages, Cowpea is a heat-loving, drought-tolerant crop with a high protein content and lower soil fertility requirements than many other crops (Coetzee, 1995). It was considered one of the most important summer legume crops in the former Union of South Africa (Summerfield *et al.*, 1974) and Quass, 1995). Cowpea has outstanding potential for intercropping and crop rotation. In Africa, cowpea has been intercropped for a long time with various other crops such as maize, groundnuts, bulrush millet and other small grains (Johnson, 1970). According to Blade *et al.* (1992) 98% of cowpea grown in Africa is intercropped. Cowpeas can be intercropped with taller plants, such as maize, particularly in high rainfall areas, due to their exceptional shade tolerance (Johnson, 1970). They are also outstanding as a straight rotational crop because of their susceptibility to root-knot nematodes and their beneficial effect on subsequent maize crops, which lasts even for the second succeeding crop. The crude protein content of cowpea hay compares favourably with that of lucerne.

An animal production study (Philips *et al.*, 1996) has shown that the average daily gain (ADG) of cows and sheep on cowpeas is more than on rye grass and compares favourably with that on clover pastures.

The main use of cowpea as a vegetable crop is as a legume, especially for small scale farmers in rural areas (Kay, 1979; Coetzee, 1995). It is very palatable, highly nutritious and relatively free of metabolites or other toxins (Kay, 1979; Quass, 1995). The seeds also contain small amounts of ß-carotene equivalents, thiamin, riboflavin, vitamin A, niacin, folic acid and ascorbic acid (Kay, 1979; Tindall, 1983). The use of cowpea seeds as a

seed vegetable provides an inexpensive source of protein in the diet. The present study aimed at determining the feasibility of using cowpea as summer legume crops in animal feed.

MATERIALS AND METHODS

Feeding trial

This study was conducted on 12 Ossimi lambs in Ismailia Agricultural Research Station, Ismailia province. Animals were divided into two equal groups. The average initial body weight was 21.3 kg for whole crop corn silage group and 20.8 kg for cowpea silage group. The two experimental groups were supplemented with concentrate feed mixture at level 1% of live body weight. Animals were kept in separate pens. Rations were offered twice daily (1% of BW concentrate + whole corn silage ad libitum and 1% of BW concentrate + cowpea silage ad libitum) and fresh drinking water was available all the time. Fasting body weight was individually recorded once monthly, and all animal were in a good health.

Silage preparation

Forages were wilted overnight, chopped (1-2 inch length) and conserved for 8 weeks in separate trench silos with 5% molasses for cowpea only. The chopped materials of the two different silages were ensiled in full capacity of about 5 tons, placed into the silos, compressed and then covered with polyethylene sheet and rice straw plus clay to insure anaerobic conditions.

Digestibility trial

The first digestibility trial was carried out to evaluate the digestibility and feeding value of each the two different silages by using 6 mature ossimi male (three for each). At the end of the feeding trial , three animals from each group was chosen to evaluate the digestibility and feeding value of the three different rations. The animals were housed in separate metabolism crates. Each trial lasted 21 days including 14 days as adaptation period. The animals were fed twice daily and fresh drinking water was freely available. Total faeces voided were weighed, wrapped in aluminum foil and dried in oven at 60°C until constant weight. The dried faecal samples were ground and stored for analysis. Proximate analysis of the diets and faeces were carried out according to the methods of A.O.A.C. (1990). Silage quality was measured according to the method of Research Institute for Cattle Feeding at Hoorn, Holland (1961).

All data were subjected to analysis of variance using the General Linear Models (GLM) procedure of SAS (1994), Mean differences were compared using Duncan' multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition

The chemical composition of preconserved forages (whole crop corn and cowpea + 5% molasses as stored) and concentrate mixture are presented in Tables 1. It could be observed that crude protein content was higher in cowpea than whole crop corn. While, there was a detectable variation concerning crude fiber content and opposite trend was observed regarding nitrogen free extract content. These results are in accordance with those reported by Kay, (1979); Tindall, (1983); Quass, (1995). Data regarding chemical composition and silage quality of the two different silages indicated that whole crop corn and cowpea (with 5% molasses) produced good quality silage (Table 2). Crude protein and nitrogen free extract content were higher in cowpea than whole crop corn silage. While, opposite trend was observed regarding crude fiber content. These results indicate that cowpea can be considered one of the most important summer legume crops because of its high protein content. These results are in agreement with those reported by Summerfield *et al.*, (1974) and Coetzee, (1995).

Table (1) Chemical composition of preconserved forages (whole crop corn and cowpea as stored) and concentrate mixture

Items	Whole crop corn	Cowpea + 5% molases	Cowpea	Concentrate mixture
DM	33.45	26.32	25.21	86.41
CP	9.17	16.11	16.75	13.43
CF	34.68	24.52	24.82	17.21
EE	1.56	3.31	3.32	3.14
NFE	39.37	41.76	40.63	54.76
Ash	15.22	14.30	14.48	11.46

Table (2) Average chemical composition of forage silages as fed

Items	Whole crop corn	Cowpea
Proximate analysis		
DM	37.41	28.49
CP	9.83	13.17
CF	30.43	23.34
EE	2.01	2.23
NFE	45.48	51.95
Ash	12.25	9.31
Silage quality		
PH	4.26	4.31
Ammonia-N	0.19	0.26
Acetic acid	2.91	2.63
Propionic acid	0.37	0.51
Butyric acid	0.21	0.25
Lactic acid	8.01	7.24
Total VFA's	3.49	3.39

Digestibility and Feeding value

Digestibility coefficients and feeding value of the forages silage are presented in Table 3 showed that differences in the digestibility of all nutrients were significant (P<0.05), except CP and NFE were not significant. The present results agree with those reported by Tjandraatmadja, *et al.* (1993) who concluded that whilst digestibility of legume silages was low, intakes and rumen fermentation characteristics were similar to those for temperate grass silages. The nutritive value on dry matter basis, as TDN was not significantly different. But, SV and DCP were significantly (P<0.05) higher with cowpea than whole crop corn silage. Because, of its higher content of crude protein (16.11% Vs 9.17%) and lower content of crude fiber (24.52% Vs 34.86% respectively). The results indicated that cowpea can be successfully ensiled with carbohydrate additives such as molasses. These results are in harmony with those reported by Sharma, *et al.*, (1983), Kiesling and Swartz, (1997) and Santra, *et al.*,(1999) who revealed that cowpea can be used as an alternative feed source for finishing lambs during the summer months. Table 4, shows the digestibility coefficients and feeding value of forages silage supplemented with 1% concentrate mixture. There were significant improvements in all figures by supplemented concentrates with silage. These results are in agreement with those reported by Sharma, *et al.* (1983) and Kumar, *et al.* (1989) who found significant improvement performance by adding 100g concentrate to the cowpea diet fed to sheep.

Table (3) Digestibility coefficients and feeding value of the obtained forage silages

Items	Whole crop corn silage	Cowpea silage
Digestibility coefficients		
DM	63.42 b	65.91 a
OM	65.61 b	68.03 a
CP	62.21 a	61.42 a
CF	73.34 a	66.71 b
EE	75.61 a	67.52 b
NFE	72.41 a	69.32 a
Nutritive values		
TDN	62.30 a	59.78 a
SV	41.44 b	44.21 a
DCP	5.70 b	9.89 a

Table (4) Digestibility coefficients ad feeding value of the forages silages supplemented with concentrate mixture

Items	Whole crop corn	Cowpea
Digestibility coefficients		
DM	66.67 a	67.33 a
OM	68.49 a	69.04 a
CP	65.27 a	64.31 a
CF	77.32 a	70.60 b
EE	74.62 a	68.13 b
NFE	75.67 a	70.34 b
Nutritive values		
TDN	66.31 a	64.03 a
SV	46.52 a	48.35 a
DCP	9.91 b	13.36 a

Growth performance and Feed intake

Data of growth performance and feed intake during the period of the experiment are summarized in Table 5. It could be shown that sheep fed whole crop corn silage ration consumed more feed as DM, TDN and SV either per head or metabolic body size, and had higher ($P<0.05$) daily gain than that fed cowpea silage. While, opposite trend was observed regarding DCP. But, there was no significant difference regarding total gain between whole crop corn and cowpea silages. Therefore, it is noteworthy to indicate that cowpea can be used as an alternative feed source for finishing lambs during the summer months. These results are in agreement with those reported by Philips, et al. (1996) and Chakeredza, *et al.* (2002) who concluded that cowpea can improve the ruminal environment in animals. Therefore, it will be reflected on the average daily gain (ADG) of cows and sheep.

Table (5) Feed intake and growth performance of lambs fed the two different rations

Items	Corn silage	Cowpea silage
Period /day	84	84
No-animal	6	6
Growth performance		
Initial weight/kg	21.3	20.8
Final weight/kg	36.28 a	35.85 b
Total gain/kg	15.28 a	14.85 a
Daily gain/gm	181.9 a	176.87 b
Feed intake		
Silage as fed / kg	2.357	2.714
Concentrate / kg	0.286	0.278
DM intake g/kg $^{0.75}$	105.05	98.56
TDN g/kg $^{0.75}$	69.63	63.14
SV g/kg $^{0.75}$	48.84	47.64
DCP g/kg $^{0.75}$	10.39	13.14

In conclusion, it is advisable to give more attention to cowpea as summer legume crop. It has outstanding potential for making a good quality silage such as maize to reach the potential performance, comprising 97% of those fed corn silage.

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الملخص العربي

تأثير التغذية على سيلاج لوبيا العلف أو سيلاج محصول الذرة الكامل على النمو و الاستفادة من المركبات الغذائية فى الحملان الاوسيمى

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أجريت هذه الدراسة بهدف تقييم سيلاج لوبيا العلف كمحصول صيفي لسد العجز فى الأعلاف الصيفية و للحد من المنافسة بين الإنسان و الحيوان على الذرة . و استخدم في هذه التجربة ١٢ حمل اوسيمى و قسمت ألي مجموعتين متماثلتين تقريبا. المجموعة الأولى كانت تتغذى على علف مركز بنسبة ١ % من وزن الجسم بجانب سيلاج الذرة حتى الشبع. بينما المجموعة الثانية قد غذيت على علف مركز بنسبة ١ % من وزن الجسم بجانب سيلاج لوبيا العلف حتى الشبع.

أجريت تجربتي هضم الأولى للسيلاج فقط والثانية للسيلاج مع العلف المركز بجانب تجربة نمو.

أظهرت أهم النتائج إن محتوى البروتين كان أعلى فى لوبيا العلف مع ٥% مولاس (١٦,١١ مقابل ٩,١٧) بالمقارنة بالذرة بينما كانت نسبة الألياف أعلى فى الذرة(٣٤,٨٦ مقابل ٢٤,٥٢) و إن السيلاج المنتج من لوبيا العلف مع ٥% مولاس لايقل جودة عن سيلاج الذرة.

كما أظهرت النتائج الخاصة بالقيمة الغذائية للسيلاج المنتج من كلا المحصولين إن مجموع المكونات الغذائية المهضومة كان أعلى لسيلاج الذرة مقابل سيلاج لوبيا العلف (٦٢,٣ مقابل ٥٩,٧٨) بينما كان معادل النشا أعلى لسيلاج لوبيا العلف (٤٤,٢١ مقابل ٤١,٤٤) و كذلك البروتين الخام المهضوم (٩,٨٩ مقابل ٥,٧) مقارنا بسيلاج الذرة. تحسن معامل الهضم و القيمة الغذائية بإضافة العلف المركز بجانب السيلاج.

أظهرت نتائج النمو انة ليس هناك اختلافات معنوية بين كلا النوعين من السيلاج بالنسبة لمعدلات النمو. ومن هذا يتضح انه يمكن إن يستخدم لوبيا العلف كغذاء صيفي لسد الفجوة الغذائية خلال فصل الصيف وكذلك لحد من المنافسة بين الإنسان و الحيوان على الذرة.