

PERFORMANCE OF GROWING LAMBS FED TWO CUTS OF SOME SUMMER GREEN FORAGE MIXTURES OF LEGUMES AND GRASSES

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ABSTRACT

The objective of this work was to study cultivation and utilization of three intercropped green forage mixtures in feeding growing lambs. Eighteen lambs divided into 3 groups (6 each) and about 20.71 kg live body weight fed 1% of BW concentrate feed mixture (CFM) + green forage mixtures offered *ad lib* as Sesbania-Sudan grass (SS) or Cowpea-Millet (CM) or Cowpea-Millet x Napier grass hybrid (CMN). Three digestibility trials were carried out to evaluate the three rations using 3 rams for each. Rumen and blood parameters were measured. Growth performance and feed conversion were determined.

The obtained results showed that Sesbania-Sudan grass mixture had higher DM, CP and NFE % and lower CF and Ash% than Cowpea-Millet or Cowpea-Millet x Napier grass hybrid mixtures. The DM intake of the three groups (SS, CM and CMN) as g/kg $W^{0.75}$ or % BW were nearly similar. The digestion coefficients of DM, OM, EE and NFE for SS were significantly higher than for CM and CMN in the 1st cut. In the 2nd cut, the digestion coefficients of OM, CP and NFE in SS were significantly higher than CM and CMN. The TDN and DCP of SS were significantly higher than CM and CMN in the two cuts. The differences in ruminal pH values among the three groups were not significant. Ruminal ammonia-N was significantly higher and total VFA,s was significantly lower in SS group than CM and CMN groups, while the difference between CM and CMN were not significant. The maximum values of ammonia-N and total VFA,s were estimated and shown 4 hrs post feeding. No significant differences among the three groups for serum total protein, albumin, globulin, urea-N, creatinine, glucose, Alkalinephosphatase (ALP), GOT and GPT. Average total gain and daily body gain of lambs fed SS were significantly higher than those fed CM or CMN. The feed conversion as kg DM/kg gain of SS group was better than CM-or CMN- groups. It could be concluded that the group fed Sesbania-Sudan grass mixture (SS) was better than other groups.

Key words: *Sesbania, Cowpea, Sudan grass, Millet, Millet x Napier grass hybrid, Digestibility, Rumen, Blood, daily body gain.*

INTRODUCTION

The animals suffer shortage of feed especially during summer season in Egypt. Most of animal feeding in this period depends on concentrate feed mixtures and agricultural residues. The expensive prices of grains enforce the increased feed cost for animals. The green forage rather than being a cheap food for ruminant it improved animal health and reduce health maintaining expenses. The most available green forages in summer season in Egypt are grasses as Sorghum, Sudan grass, Millet, Napier grass, and Teosinte whom have low protein content. Therefore the grasses needs supplement of protein which could be concentrates or legume forages. High yielding and high quality legume-grass mixtures play an important part in forage-animal production system

(Mooso and Wedin, 1990). An attempts were carried out to introduce new legumes as Sesbania (Soliman et al, 1997 and Haggag et al., 2000) or grasses as Millet x Napier grass hybrid (Zeidan and Geweifel, 1997). On the other side, some practical studies were carried out to utilize some mixtures of legumes and grasses in ruminant feeding such as cowpea with sorghum (Gabra et al, 1991) and Sesbania with Teosinte (Soliman et al., 1997 and Soliman and Haggag, 2002). The objective of this work was to study cultivation of some intercropped legume-grass mixtures and their utilization in feeding growing lambs.

MATERIALS AND METHODS

This work was carried out at El-Serw Experimental Station (Domieta governorate), Agriculture Research Center (ARC), Egypt. Three field trials utilized legume-grass mixtures were conducted. The 1st trial was sowing Sesbania (*Sesbania Sesban*) intercropped with Sudan grass (*Sorghum vulgare*), the 2nd trial was Cowpea (*Vigna sinensis*) intercropped with Millet (*Pennisetum maximum*) and the 3rd trial was Cowpea intercropped with Millet (*Pennisetum maximum*) x Napier grass (*Pennisetum purpureum*) hybrid. The seeding rate for the planted forage mixtures were 10, 10, 15 and 15 kg/feddin for Sesbania, Cowpea, Sudan grass and Millet, respectively while Millet x Napier grass hybrid was planted by offshoots. The normal recommended agronomic practices, i.e. irrigation, fertilization, etc. of forages were applied. Two cuts of green forage mixtures were taken. The 1st cuts were don about 60 days from planting. The 2nd cuts were taken 40 days after regrowth from 1st cut. Eighteen Rahmani lambs weighed on average 21 kg were assigned randomly to three groups (6 animals each) according to their live body weight. The 1st group (SS) was fed 1% of body weight concentrate feed mixture (CFM) + Sesbania-Sudan grass mixture, the 2nd group (CM) was fed 1% of body weight CFM + Cowpea-Millet mixture and the 3rd group (CMN) was fed 1% of body weight CFM + Cowpea-Millet x Napier grass hybrid mixture. The CFM was offered twice daily at 8:00 am and 3:00 pm, while green forage mixtures were fed *ad libitum*. Drinking water was available all times. The experimental period lasted 120 days.

Digestibility trials were conducted on 9 mature rams in complete randomized design to evaluate the three treatments (3 animals in each). Animals were individually kept in a metabolic cages. Each trial lasted 26 days as 21 days preliminary period followed by 5 days collection period. The samples of green forage and feces were dried in an oven at 60°C for 48 hours, then thoroughly mixed and chemical analyzes were carried out according to the methods of A.O.A.C. (1995).

At the end of feeding trial, only three lambs of each group were used for collecting rumen and blood samples. Rumen fluid samples were obtained using a rubber stomach tube at before morning feeding (0 time) and 2, 4 and 6 hours post morning feeding. The samples were filtered through three layers of cheese cloth without squeezing. The ruminal fluid pH values were immediately estimated by a digital pH-meter. The ruminal

ammonia-N concentration was determined according to **Conway (1957)**. Total volatile fatty acids (TVFA,s) were determined by the steam distillation method as described by **Warner (1964)**. Blood samples were taken via the jugular vein in evacuated tubes. Samples were kept at room temperature for 45 min. then centrifuged at 4000 r.p.m. for 15 min., then blood serum was separated and transferred into clean dried glass vials and stored frozen at -20°C until analysis for total protein (TP) (**Armstrong and Carr, 1964**), Albumin (**Daumas et al., 1971**), glucose (**Trinder, 1969**), Urea-N (**Patton and Crouch, 1977**), creatinine (**Husdan, 1968**), Alkaline phosphatase (**Haussament, 1977**) and Transaminases (GOT and GPT) (**Reitman and Frankel, 1957**)

The statistical analysis was carried out with Costate version 3.03 Software (**Costate, 1986**). Significance for mean differences were tested according to **Duncan's New Multiple Range Test (1955)**.

RESULTS AND DISCUSSION

Chemical composition of some legume-grass mixtures:

The chemical analysis of legume-grass mixtures as shown in Table 1 explained that the dry matter (DM) percent of Sesbania-Sudan grass mixture was higher than Cowpea-Millet or Cowpea-Millet x Napier grass hybrid mixtures in the 1st or 2nd cuts. In the same trend, crude protein (CP) and nitrogen free extract (NFE) percent in Sesbania-Sudan grass mixture was higher than Cowpea-Millet or Cowpea-Millet x Napier grass hybrid mixtures. The increase in CP of Sesbania-Sudan grass mixture may be due to the high CP content in Sesbania as showed by **Soliman et al. (1997)** and **Soliman and Haggag, (2002)**. The percentages of crude fiber (CF) and Ash percent of Sesbania-Sudan grass mixture was lower than Cowpea-Millet or Cowpea-Millet x Napier grass hybrid mixtures. The chemical composition of mixtures was slightly differ than that obtained by **Gabra et al., (1991)** on Cowpea-Sorghum mixtures and **Soliman and Haggag (2002)** on Sesbania-Teosinte mixture. The same authors found that chemical composition of legume-grass mixtures are intermediate between legumes and grasses. Generally **Gabra et al. (1991)** and **Khinizy et al. (1997)** found that Cowpea had a high content of CP and low content of CF and NFE than grasses (Sudan grass, Sorghum, Napier grass and Millet). **Soliman et al. (1997)** and **Soliman and Haggag (2002)** found that Sesbania forage had high CP and low NFE percent compared with Teosinte grass. In this respect, there are many factors affecting chemical composition as species and varieties of forages, soil, fertilization, subsequent cuts, age of cuts and environmental condition (**Gabra et al., 1991, Van Soest, 1996 and Haggag et al., 2000**).

Feed intake:

The DM intake of the three groups (SS, CM and CMN) as g/kg W^{0.75} or % of BW were nearly similar (Table 2), In this connection, **Gabra et al. (1991)** found that DM intake of Cowpea-Sorghum mixture was higher than Sorghum alone while, the DM intake of different grasses as sweet Sorghum or Sordan grasses was nearly equal.

Table 1. Chemical composition of some legume-grass mixtures fed to Rahmani lambs.

Items	DM	OM	CP	CF	EE	NFE	Ash
1 st cut							
Sesbania-Sudan grass	18.21	90.5	16.05	30.95	1.95	41.55	9.5
Cowpea-Millet	17.53	85.93	15.27	32.91	1.79	35.96	14.07
Cowpea-Millet x Napier grass hybrid	16.74	86.29	15.13	32.77	1.85	36.54	13.71
2 nd cut							
Sesbania-Sudan grass	19.65	89.75	15.62	32.33	1.81	39.99	10.25
Cowpea-Millet	18.81	87.15	14.31	33.72	1.85	37.27	12.85
Cowpea-Millet x Napier grass hybrid	17.31	87	14.75	33.21	1.87	37.17	13
CFM	90.85	92.97	15.31	16.05	3.19	58.42	7.03

Khinizy *et al.* (1997) found that, feed intake of legumes as Cowpea was higher than grasses as Sorghum or Millet. The millet intake was lower than Napier grass intake. **Soliman *et al.* (1997)** showed that dry matter intake of Sesbania-Teosinte mixture was higher than Teasinte alone. Generally, **Ibrahim *et al.* (2008)** found that DM intake of Napier grass x Millet hybrid and Millet were nearly similar.

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Table 2. Average feed Intake of Rahmani lambs fed rations contained legume - grass mixtures.

Items	SS	CM	CMN
The 1 st period*			
DM intake, g/h/d			
Forage mixtures	739	721	728
CFM	258	253	252
Total DM intake	997	974	980
DM intake, g/kg W ^{0.75}	89.1	87.59	88.45
DM intake, % BW	3.98	3.92	3.97
The 2 nd period*			
DM intake, g/h/d			
Forage mixtures	993	965	976
CFM	341	333	335
Total DM intake	1334	1298	1311
DM intake, g/kg W ^{0.75}	94.88	95.23	95.21
DM intake, % BW	3.93	3.99	3.97

SS: 1% of BW CFM + *ad lib* Sesbania-Sudan grass mixture.

CM : 1% of BW CFM + *ad lib*. Cow pea-Millet mixture

CMN: 1% of BW CFM + *ad lib* Cow pea-Millet x Napier grass hybrid mixture.

Digestion coefficients and nutritive values:

The digestion coefficients and nutritive values as shown in table 3 indicate that in the 1st cut digestion coefficients of DM, OM, EE and NFE for SS were significantly higher than that for CM and CMN, while the differences between CM and CMN were not significant. The CF digestibility of CM was significantly lower than SS or CMN. The differences of CP digestibility among the three rations were not significant. In the 2nd cut, the digestion coefficients of OM, CP and NFE in SS were significantly higher than CM and CMN, while the differences between CM and CMN were not significant. The differences in CF and EE digestibility among the three rations were not significant. **Gabra et al. (1991)** found that digestion coefficients of DM and OM of Cowpea-Sorghum mixture was higher than Sorghum alone. **Soliman et al. (1997)** showed that, digestion coefficients of all nutrients of rations contained Sesbania-Teosinte mixture was higher than those contained Teosinte grass. **Ibrahim et al. (2008)** found that, digestion coefficients of nutrients of Napier grass x Millet hybrid were higher than Napier grass or Millet especially in 2nd cut. On the other side, **Khinizy et al. (1997)** found that, digestion coefficients of DM, OM, CF and NFE of some summer grasses as

Sorghum, Millet and Napier grass were nearly similar. The TDN and DCP of SS were significantly higher than CM and CMN in the two cuts. The CM ration had a lower nutritive values as TDN and DCP in the 1st and 2nd cuts. **Gabra *et al.* (1991)** found that, TDN of Cowpea-Sorghum mixture and Sorghum alone were nearly similar, while DCP of Cowpea-Sorghum mixture was higher than Sorghum alone. **Soliman *et al.* (1997)** found that, TDN and DCP of the ration contained Sesbania-Teosinte mixture were higher than that contained Teosinte. **Ibrahim *et al.* (2008)** found that DCP of Napier grass x Millet hybrid were higher than Napier grass or Millet, while the TDN of the three grasses were nearly similar. However, **Khinizy *et al.* (1997)** found that, nutritive values as TDN and DCP of Millet and Napier grass were nearly similar. Generally, the digestion coefficients and nutritive values of rations contained green forages are affected by some factors as species and varieties of forages, subsequent cuts, age of cuts, legume/grass ratio and forage/concentrate ratio.

Table 3. Digestion coefficients (%) and nutritive values (%) of the rations contained legume - grass mixtures.

Items	1st period (1st cut)			2nd period (2nd Cut)		
	SS	CM	CMN	SS	CM	CMN
Digestion coefficients						
DM	66.99 ^a	63.63 ^b	65.02 ^b	67.00 ^a	64.29 ^b	65.16 ^{ab}
OM	69.64 ^a	64.75 ^b	66.05 ^b	68.91 ^a	65.54 ^b	66.37 ^b
CP	79.44	76.07	76.55	79.61 ^a	75.50 ^b	76.83 ^b
CF	73.05 ^a	71.86 ^b	73.12 ^a	74.25	72.96	73.2
EE	67.31 ^a	61.11 ^b	63.11 ^b	63.94	61.92	63.91
NFE	63.45 ^a	53.63 ^b	55.60 ^b	60.96 ^a	54.98 ^b	56.21 ^b
Nutritive values						
TDN	64.66 ^a	57.00 ^c	58.47 ^b	63.62 ^a	58.45 ^b	59.29 ^b
DCP	12.75 ^a	11.61 ^b	11.98 ^b	12.43 ^a	10.79 ^c	11.33 ^b

^{abc} means in the same line with different superscripts differ significantly ($P < 0.05$)

Rumen parameters:

The rumen parameters as shown in table 4 showed that differences in ruminal pH values among the three groups were not significant. However, the obtained pH values are within the normal range for normally functioning rumen (5.5 to 7.3) as recorded by **Hungate (1966)**. Ammonia-N of SS was significantly higher than CM and CMN, while the difference between CM and CMN was not significant. The high content of ammonia-N in SS may be due to the high content of CP in Sesbania forage as recorded

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by **Soliman *et al.* (1997)** and high protein degradability of *Sesbania* protein as reported by **Khalili and Varvikko (1992)**. The total VFA,s of SS was significantly lower than CMN, while, the differences between SS and CM were not significant. The maximum values of Ammonia-N and total VFA,s were shown at 4 hrs post feeding. Similar findings were shown by **Soliman *et al.* (1997)** and **Abdel Rahman *et al.* (2001)**. **Ibrahim *et al.* (2008)** found no significant differences in pH, ammonia-N and total VFA,s for the rumen of rams fed Napier grass x Millet hybrid, Napier grass or Millet.

Table 4. Rumen parameters of rahmani lambs fed rations contained legume - grass mixtures.

Items	Time hrs	SS	CM	CMN	Aver.
Rumen parameters					
pH	0	6.97	6.93	6.97	6.96
	2	6.6	6.5	6.53	6.54
	4	6.43	6.4	6.4	6.41
	6	6.52	6.47	6.5	6.49
Aver.		6.93	6.58	6.6	
Ammonia-N (Mg/100ml)	0	12.8	12.3	11.9	12.33C
	2	20.33	18.73	18.53	19.20b
	4	22.27	20.33	19.47	20.69a
	6	21.6	19.2	18.73	19.84Ab
Aver.		19.25a	17.64b	17.16b	
Total VFA,s (mEq/100ml)	0	7.73	8.13	8.37	8.08d
	2	9.2	9.57	9.63	9.47C
	4	10.97	11.37	11.5	11.28a
	6	10.23	10.57	10.83	10.54b
Aver.		9.53b	9.91ab	10.08a	

^{ab} means in the same line with different superscripts differ significantly (P<0.05)

^{ABCD} means in the same column with different superscripts differ significantly (P<0.05)

Blood parameters:

Values of some blood parameters as shown in table 5 show no significant differences among three rations in serum total protein, albumin, globulin, urea-N, creatinine, glucose, Alkalinephosphatase (ALP), GOT and GPT. Meanwhile, all animals in different treatments were healthy. The obtained values are within the normal range

reported by **Abdel Rahman *et al.* (2001)** and **Salem (2003)** for lambs. No significant differences among the treatments

Table 5. Blood serum parameters of Rahmani lambs fed rations contained legume - grass mixtures.

Items	SS	CM	CMN
Total protein, g/dl	6.87	6.93	6.57
Albumin, g/dl	3.1	3.13	3
Globulin, g/dl	3.77	3.8	3.57
Al/Gl ratio	0.82	0.82	0.84
Urea-N, mg/dl	14.27	13.43	12.87
Creatinine, mg/dl	1.33	1.23	1.27
Glucose, mg/dl	67.8	72.7	70.7
Alkalinephosphatase (ALP), U/L	138	133	127
GOT	68.67	66	65.33
GPT	13.23	12.37	12.33

Growth performance and feed conversion:

Average total gain and daily body gain of lambs fed Sesbania- Sudan- grass mixture (SS) were significantly ($P<0.05$) higher than those fed Cowpea- Millet mixture (CM) or those fed Cowpea-Napier grass x Millet hybrid mixture (CMN) in both periods and total period as shown in table 6. The total gain and daily body gain of CMN group were significantly ($P<0.05$) higher than CM group in the 2nd period while the differences between CM and CMN in the 1st period and total period were not significant. The feed conversion as kg DM/kg gain Of SS group was better than CM or CMN groups. The feed conversion as kg TDN or kg DCP/kg gain were nearly equal. . **Soliman *et al.* (1997)** and **Abdel-Rahman *et al.* (2001)** found that, growth performance and feed conversion of legume-grass mixture was better than legumes or grasses alone

Conclusion It could be concluded that the Sesbania-Sudan grass mixture was better than mixtures of Cowpea-Millet and Cowpea-Millet x Napier grass hybrid as green forage in growing lamb feeding in the summer season which led to improve chemical composition, digestibility of most nutrients, average daily gain and feed conversion .

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Table 6. Average daily gain of rahmani lambs fed rations contained legume - grass mixtures.

Items	SS	CM	CMN
No. of animals	6	6	6
initial body wt, kg	20.43a	20.82a	20.90a
Body wt at 60days, kg (1 st period) ¹	29.65a	28.82a	29.1a
Total gain (1 st period), kg	9.22a	8.00b	8.20b
Daily gain, g (1 st period)	154a	133b	137b
Body wt at 120days,kg (2 nd period) ²	38.20a	36.32b	36.92b
Total gain (2 nd period), kg	8.55a	7.50c	7.82b
Daily gain, g (2 nd period)	143a	125c	130b
Total gain (total period), kg	17.77a	15.50b	16.02b
Aver. daily gain,g (total period), kg	148a	129b	134b
Feed conversion			
1st period			
Kg DM/kg gain	6.47	7.5	7.15
Kg TDN/kg gain	4.18	4.28	4.22
Kg DCP/kg gain	0.82	0.87	0.86
2nd period			
Kg DM/kg gain	9.33	10.38	10.08
Kg TDN/kg gain	5.94	6.07	5.98
Kg DCP/kg gain	1.16	1.12	1.14
Whole period			
Kg DM/kg gain	7.88	8.81	8.55
Kg TDN/kg gain	5.05	5.09	5.03
Kg DCP/kg gain	0.99	0.99	1

^{a,b,c} Means in the same line with different superscripts significantly differ (P<0.05).

1: The lambs in 1st period were fed 1st cut of legume - grass mixtures.

2: The lambs in 2nd period were fed 2nd cut of legume - grass mixtures.

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الأداء الانتاجي للحملان النامية المغذاة على بعض الأعلاف الخضراء الصيفية

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معهد بحوث الانتاج الحيوانى - مركز البحوث الزراعية - وزارة الزراعة - مصر

أجريت هذه الدراسة بهدف زراعة واستخدام ثلاثة مخاليط علفية خضراء هي :
١- السيسبان وحشيشة السودان ٢- لوبيا العلف والدخن ٣- لوبيا العلف والدخنابير (هجين الدخن وعلف الفيل) وقد استخدمت المخاليط الثلاثة فى تغذية الحملان الرحمانى باستخدام ١٨ حمل قسمت إلى ثلاثة مجموعات بكل مجموعة ٦ حملان وغذيت على ثلاثة علائق كالاتى:- المجموعة الأولى غذيت على ١% من وزن الجسم علف مركز + السيسبان وحشيشة السودان والمجموعة الثانية غذيت على ١% علف مركز + لوبيا العلف والدخن والمجموعة الثالثة غذيت على ١% علف مركز + لوبيا العلف والدخنابير وذلك لمدة ١٢٠ يوم. وقد تم التحليل الكيماوى للمخاليط الثلاثة كما أجريت تجارب هضم لتقييم العلائق الثلاثة باستخدام ٩ كباش (٣ بكل مجموعة)، كما تم إجراء بعض القياسات على سائل الكرش والدم. وكان يتم وزن الحيوانات كل ١٥ يوم لحساب العائد اليومى فى وزن الجسم.

أوضحت النتائج المتحصل عليها أن نسبة البروتين الخام فى مخلوط السيسبان وحشيشة السودان كان مرتفعا عن مخلوط لوبيا العلف والدخن ومخلوط لوبيا العلف والدخنابير بينما كانت نسبة الألياف الخام ومستخلص الإثير والكربوهيدرات الذائبة متقاربة فى المخاليط الثلاثة. كان المأكول من العلائق الثلاثة متساويا تقريبا. كانت معاملات الهضم للمادة الجافة والمادة العضوية والبروتين ومستخلص الإثير للمجموعة الأولى مرتفعة معنويا عن المجموعة الثانية بينما لم تكن هناك فروق معنوية بين كل من المجموعة الأولى والمجموعة الثالثة أو المجموعة الثانية والمجموعة الثالثة، كما كانت الفروق فى معاملات هضم الكربوهيدرات الذائبة غير معنوية بين المجموعات الثلاثة. وكانت المركبات الكلية المهضومة للعليقة الأولى مرتفعة معنويا عن العليقة الثانية فى الحشة الأولى وعن كل من العليقة الثانية والثالثة فى الحشة الثانية وكان البروتين المهضوم للعليقة الأولى مرتفعا معنويا عن العليقة الثانية والثالثة اللتين لم يكن بينهما فروق معنوية. أظهرت دراسات الكرش عدم وجود فروق معنوية فى ال pH. بينما كانت أمونيا الكرش مرتفعة معنويا مع العليقة الأولى عن العليقة الثانية وغير معنويا عن الثالثة، وكانت المجموعة الأولى منخفضة معنويا فى الأحماض الدهنية الطيارة ومرتفعة معنويا فى البروتين الميكروبي عن المجموعتين الثانية والثالثة. وبالنسبة لمقاييس الدم لم تكن هناك فروق معنوية بين المجموعات الثلاثة فى كل من الهيموجلوبين وكرات الدم الحمراء أو البروتين والجلوبيولين والألوبيومين والجلوكوز والكرياتين فى السيرم. نستنتج من هذه الدراسة ان تغذية الحملان النامية على أى من المخاليط التالية: السيسبان وحشيشة السودان - لوبيا العلف والدخن- لوبيا العلف والدخنابير (هجين الدخن وعلف الفيل) خلال موسم الصيف تؤدى الى تحسين معظم معاملات الهضم والقيم الغذائية ومعدل النمو اليومى وكفاءة تحويل الغذاء وانخفاض تكاليف الغذاء اللازم لانتاج كيلو جرام نمو.