

A Study on the Effect of Alfalfa in Sheep Rations on Feeding Efficiency and Reproductive Performance

Al-Geldawy¹ A. R.; A. A. Osman²; M. M. Awad² and M. F. El-Sayes³

¹ Improved Agricultural Systems Project, Ismailia, Agricultural Research Centre, Egypt.

² Department of Animal Production, Faculty of Agriculture, Suez Canal University, Egypt.

³ Animal Production Research Institute, Agriculture Research Center, Egypt.

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Abstract: The objectives of the present study were to investigate the effects of alfalfa forage in ewes' rations on feeding and reproductive performance. Three experiments were carried out in this study during 10 months, the first experiment was carried out on 51 local ewes in 3 groups (17 in each) and the second experiment was carried out on 9 ewes (3 in each), while the third experiment was conducted on a mature fistulated Buffalo bull. The rations provided to animals were classified into three experimental rations. The first ration (control) was made up of 82% concentrate feed mixture (CFM) and 18% wheat straw, the second ration consisted of 50% CFM, 30% fresh alfalfa and 20% maize grains and The third ration composed of 60% fresh alfalfa and 40% maize grains, on DM basis. The rations were offered to ewes in quantities to meet the nutrient requirements according to NRC (1985). Animals in exp. 1 and 2 were randomly allotted into three treatment groups, the 1st group was control which consumed the 1st ration, treatment 1(T1) which consumed the 2nd ration and treatment 2(T2) which consumed the 3rd ration. Results revealed that a significantly increase ($p \leq 0.05$) in a crude protein disappearance of alfalfa than concentrate feed mixture or maize grains was observed at 4 hrs. post-incubation. Control group which was fed on CFM and wheat straw had a significantly increase ($p \leq 0.05$) in conception rate and lambing rates than other groups (T1 and T2 which were fed on rations contained alfalfa). On the other hand, T2 had the significantly higher concentration ($p \leq 0.05$) of Progesterone than T1 and control at the 3rd day before estrus day. This study showed that the use of alfalfa caused reduction in reproductive efficiency of ewes and recommended the maximum safe adding of fresh green alfalfa on the dry matter basis in the diets of ewes should not to exceed 30% of the total nutrient requirements.

Keywords: Alfalfa, Phytoestrogen, Conception rate, Lambing rate, Sheep, Sex hormone, Feed efficiency.

INTRODUCTION

Alfalfa is grown mainly on newly reclaimed lands as green forage for livestock. Eight to ten cuts per year could be obtained (Rammah *et al.*, 1995). Alfalfa is the main green forage in Ismailia Governorate for feeding ruminants.

Legumes as Alfalfa diets for ruminants contains high CP and low energy (EL-Sayes and Gaafer, 1998, Abdel-Malik *et al.*, 2001, Soliman *et al.*, 2005 and Turner *et al.*, 2011). Gabra (1984) confirmed that alfalfa forage is not adequate to fulfill animal requirements for high production. Strategic energy supplementation is usually done to increase digestible energy intake to improve performance of small ruminants (EL-Sayes and Gaafer, 1998, Soliman *et al.*, 2005 and Turner *et al.*, 2011).

Protein value of alfalfa might be reduced by nitrogen losses that occur during extensive rumen degradation (Broderick, 1995; Dhiman and Satter, 1997; Elizalde *et al.*, 1999a; Gonzalez *et al.*, 2001; Broderick, 2006; Pozdišek and Vaculova, 2008).

Alfalfa potentially contains phytoestrogens which can reduce the reproductive efficiency of domestic ruminants (Bennets, 1946, Lightfoot and Wroth, 1974, Romero *et al.*, 1997 and Clinton, 2002).

MATERIALS AND METHODS

This study was conducted at the farm of Animal Production Station of Improved Agricultural Systems Project (Suez Canal East, Ismailia Governorate, Agricultural Research Center, Egypt). Alfalfa was

cultivated in reclaimed sandy soils at the Suez Canal East (Sinai).

In Situ nylon bag technique was carried out in Ismailia Agricultural Research Station according to Mehrez and Ørskov (1977), where 4gm of dry feed sample (milled through 2 mm screen) were placed in each nylon bag prepared from polyester cloth (41 μ m pore size). The nylon bags were incubated for 4, 8 and 12 hours in rumen of buffalo bull. The *In Situ* dry matter disappearance (ISDMD), *In Situ* crude protein disappearance (ISCPD) and *In Situ* crude fiber disappearance (ISCFD) of feed samples were determined.

51 local ewes in 3 groups (17 in each) were used to study their reproductive performance and lambing production. 9 ewes from the experimental groups (3 in each) randomly selected after ewes parturition and weaning their lambs to study the effect of feeding alfalfa on the level of the progesterone hormone around estrus day.

The rations provided to animals are classified into three experimental rations, the first ration (control) was made up of 82% concentrate feed mixture (CFM) which was consist of 60% corn, 24% wheat bran 13% Soybean meal 3% feed additives, plus 18% wheat straw, the second ration (T1) consisted of 50% CFM, 30% fresh alfalfa and 20% maize grains and the third ration (T2) composed of 60% fresh alfalfa and 40% maize grains, on DM basis. The rations were calculated to meet the nutrient requirements according to NRC (1985).

Alfalfa was cutting then offered with dietary rations twice daily at 7 AM and 3 PM. Animal had access to water at all times.

Chemical analysis of ingredients and rations were determined according to the methods of A.O.A.C. (1990).

The serum progesterone level was measured by using ELISA technique according to DIA METRA for routine analysis of 17OH Progesterone (Direct immunoenzymatic determination of 17OH Progesterone in human serum or plasma).

All data were subjected to analysis of variance and least squares analysis was performed using the General Linear Models (GLM) procedure of the SAS statistical package (SAS, 1999). Mean differences were compared using Duncan's multiple range test (Duncan, 1955). Data were analyzed using the following model:

$$Y_i = \mu + T_i + e_i$$

Where

Y_i = Individual observation.

μ = the overall mean for the trait under consideration

T_i = the effect of the treatment

e_i = random residual error

RESULTS AND DISCUSSION

Chemical composition of ingredients and experimental rations:

Table (1) showed the average percentage composition of ingredients and rations of experiments. The chemical composition of ingredients showed that the crude protein (CP) content of alfalfa was very high compared with maize grains. The nitrogen free extract content (NFE) was low in alfalfa compared with maize grains. Wheat straw had a low protein and NFE and high CF. The values of chemical composition in this work are in general within the range of values obtained by Medina *et al.* (1972); Manget Ram and Mundgal (1997); Bo Gohl (1981); Chauhan *et al.* (1987); Gabra *et al.* (1992); Abd-El-Halim *et al.* (1992), Rammah *et al.* (1995) and EL-Sayes and Gaafer, (1998). In addition, the chemical composition of experimental rations showed an equal nearly values of NFE.

Table (1): Chemical composition of ingredients and rations of experiments.

Items		DM%	OM%	CP%	CF%	EE%	NFE%	ASH%
Ingredients								
*Concentrate feed mixture	as fed	88.8	77.6	14.0	6.5	2.6	54.5	11.2
	DM basis	100	87.3	15.8	7.3	2.9	61.3	12.7
Maize grains	as fed	88.5	86.2	9.1	1.9	3.9	71.3	2.3
	DM basis	100	97.4	10.3	2.1	4.4	80.6	2.6
Alfalfa	as fed	20.4	18.0	5.7	4.0	0.6	7.7	2.4
	DM basis	100	88.4	28.2	19.6	2.9	37.7	11.6
Wheat straw	as fed	92.0	79.9	4.7	31.1	1.2	42.8	12.1
	DM basis	100	86.9	5.1	33.9	1.3	46.6	13.1
Rations								
Control	as fed	89.8	79.81	11.98	10.66	2.45	54.72	10.03
	DM basis	100	88.84	13.33	11.87	2.72	60.91	11.16
Treatment 1	as fed	89.9	81.72	17.41	9.40	2.87	52.03	8.22
	DM basis	100	90.86	19.36	10.46	3.19	57.86	9.14
Treatment 2	as fed	91.4	84.35	19.84	12.68	2.94	48.90	7.03
	DM basis	100	92.31	21.71	13.87	3.22	53.51	7.69

*A concentrate feed mixture (CFM) was formulated from maize grains, 60%; wheat bran, 24%; soy bean meal, 13% and 3% mineral mix.

***In Situ* dry matter disappearance (ISDMD), *In Situ* crude protein disappearance (ISCPD) and *In Situ* crude fiber disappearance (ISCFD) of ingredients and different experimental rations:**

The dry matter disappearance of alfalfa was nearly similar with concentrate feed mixture with insignificant disappearance at all incubation periods, while dry matter disappearance of wheat straw was significantly ($p \leq 0.05$) lower than other ingredients at all incubation periods, however the dry matter disappearance of maize grains was intermediate between alfalfa and concentrate feed mixture with insignificant disappearance at 8 hrs. post-incubation and it was significantly ($p \leq 0.05$) higher than others at 12 hrs. post-incubation (Table 2). On the other hand, the dry matter disappearance of control was

significantly ($p \leq 0.05$) higher at 4 and 8 hrs. and significantly ($p \leq 0.05$) lower at 12 hrs. post-incubation than rations contained alfalfa (T1 and T2) as shown in Table 2. Similar results were showed by de Boer *et al.* (1987) and Mehrez *et al.* (2001).

The crude protein disappearance of alfalfa was significantly ($p \leq 0.05$) higher than concentrate feed mixture or maize grains at 4 hrs. post-incubation and consequently control rations was significantly ($p \leq 0.05$) lower than T2 and insignificantly lower than T1 at 4 hrs. post-incubation (Table 2). This result is lie within the data obtained by Mathers *et al.* (1977), Crawford *et al.* (1978), de Boer *et al.* (1987) and Mehrez *et al.* (2001).

The crude fiber disappearance of all ingredients was nearly and without any significant ($p \leq 0.05$)

disappearance at 4 and 8 hrs. post-incubation. ($p \leq 0.05$) higher than wheat straw at 12 hrs. post-incubation. On the other side, the crude fiber disappearance of control ration was significantly ($p \leq 0.05$) lower at 8 hrs. and insignificantly lower at 12 hrs. post-incubation than rations contained alfalfa (T1 and T2) as shown in Table 2. The values of control rations were less than of Mehrez *et al.* (2001).

Reproductive performance of ewes fed alfalfa:

Reproductive performances of ewes are presented in Table 7. The data showed that considerable variations ($P \leq 0.05$) were observed among percentages of conception rate and lambing rate and they were recorded 60, 36.4 and 18.2% conception rate and 60,

Concentrate feed mixture and alfalfa were significantly 36.4 and 15.9% lambing rate in groups of control (fed on concentrate feed mixture and wheat straw), T1 (fed on 30% alfalfa) and T2 (fed on alfalfa ration), respectively. The T2 group which was fed on alfalfa ration had a very low conception rate and lambing rates than T1 group which was fed on 30% alfalfa and control group which was fed on CFM and wheat straw. It has also been demonstrated by Bennets (1946); Lightfoot and Wroth (1974); Romero *et al.* (1997) and Clinton (2002) that Alfalfa potentially contains phytoestrogens. They reported that phytoestrogens can reduce the reproductive efficiency of domestic ruminants. While, twinning rate%, weaning rate% and ewes efficiency were insignificantly affected.

Table (2): *In Situ* DM, CP and CF disappearance of alfalfa and other ingredients utilized in ewes' rations and the different experimental rations.

Item	DM disappearance (%)			CP disappearance (%)			CF disappearance (%)		
	Incubation period (hour)			Incubation period (hour)			Incubation period (hour)		
	4	8	12	4	8	12	4	8	12
Ingredients									
Dried alfalfa	26.2 ^{ab}	34.7 ^a	26.2 ^{ab}	40.2 ^a	43.9 ^a	43.9 ^a	2.2 ^a	6.5 ^a	13.9 ^a
Wheat Straw	11.8 ^c	13.4 ^b	11.8 ^c	3.7 ^b	4.7 ^c	9.8 ^c	3.0 ^a	3.2 ^a	7.7 ^b
Maize grains	22.3 ^b	34.5 ^a	22.3 ^b	30.6 ^b	32.1 ^b	35.8 ^b	5.1 ^a	5.8 ^a	11.2 ^{ab}
Concentrate feed mixture	29.5 ^a	35.4 ^a	29.5 ^a	32.8 ^{ab}	45.5 ^a	47.2 ^a	1.9 ^a	2.0 ^a	13.8 ^a
Rations									
Control	32.2 ^a	32.9 ^a	33.2 ^c	32.4 ^b	37.8 ^a	38.3 ^b	1.5 ^a	2.0 ^b	7.2 ^a
Treatment 1	23.4 ^b	29.4 ^c	36.9 ^b	35.2 ^{ab}	37.2 ^a	43.7 ^b	5.0 ^a	5.5 ^a	8.8 ^a
Treatment 2	25.3 ^b	30.2 ^b	45.7 ^a	39.3 ^a	39.6 ^a	52.9 ^a	3.9 ^a	5.4 ^a	10.8 ^a

^{abc} means in the same columns with different superscripts are significantly ($p \leq 0.05$) differed.

Table (3): Reproductive performance of ewes fed alfalfa.

Item	Control			Treatment 1			Treatment 2		
	Insemination			Insemination			Insemination		
	1st	2nd	3d	1st	2 nd	3d	1st	2 nd	3d
Number of ewes inseminated	17	5	3	17	9	7	17	15	12
Number of ewes conceived	12	2	1	8	2	2	2	3	3
Conception rate% (CR%)	70.6	40	33.3	47.1	22.2	28.6	11.8	20	25
Overall means CR%	60.0±2.3a			36.4±1.4b			18.2±1.5c		
Number of ewes parturited	12	2	1	8	2	2	1	3	3
Lambing rate% (LR%)	70.6	40	33.3	47.1	22.2	28.6	5.9	20	25
Overall means LR%	60.0±2.3a			36.4±1.4b			15.9±1.1c		
Number of lambs were born	17	3	1	12	4	3	2	4	3
Twinning rate% (TR%)	141.7	150	100	150	200	150	200	133.3	100
Overall means TR%	140.0±3.7a			158.3±2.2a			128.6±2.5a		
Number of lambs were weaned	11	2	1	7	2	0	2	1	3
Weaning rate% (WR%)	91.7	100	100	87.5	100	0	200	33.3	100
Overall means WR%	93.3±3.3a			75.0±2.7a			85.7±2.9a		
Overall weight of lambs weaned (kg)	217.6	55.9	0	171	28.8	0	35.6	23.4	61.5
ewes efficiency EE Kg/ewe	18.1	28	0	21.3	14.4	0	35.6	7.8	20.5
Overall means EE (kg/ewe)	18.2±1.6a			16.6±1.4a			17.2±1.8a		

abc means in the same row with different superscripts differ significantly ($P \leq 0.05$).

Table (4): Performance of lambs produced by ewes fed alfalfa.

Item	Control	Treatment 1	Treatment 2
Number of Lambs born	21	19	9
Average of born weight kg	3.86	3.57	3.79
Average of weaning weight kg	19.53	22.14	20.07
Number of Lambs weaned	14	9	6
Mortality (%)	33.3	52.6	33.3
Growth rate (gm./day)	173	200	180

Table (5): Progesterone hormone level in serum of ewes fed alfalfa.

Estrus days	Progesterone Concentration (ng/ ml)		
	Control	T1	T2
-6	0.507 ^a	1.298 ^a	1.63 ^a
-5	0.734 ^a	1.686 ^a	1.48 ^a
-4	0.503 ^a	0.665 ^a	2.48 ^a
-3	0.439^b	0.375^b	2.21^a
-2	0.573 ^a	1.32 ^a	0.84 ^a
-1	0.166 ^a	0.256 ^a	0.175 ^a
0	0.140 ^a	0.152 ^a	0.222 ^a
1	0.077 ^a	0.245 ^a	0.090 ^a
2	0.164 ^a	0.336 ^a	0.117 ^a
3	0.244 ^a	0.365 ^a	0.100 ^a
4	0.077 ^a	0.384 ^a	0.017 ^a
5	0.407 ^a	0.495 ^a	0.255 ^a
6	1.035 ^a	0.604 ^a	0.420 ^a

^{ab} means in the same row with different superscripts differ significantly ($P \leq 0.05$).

In the present study, the number of lambs born of control and T1 groups was higher than T2 group and it may be referred to the significantly ($p \leq 0.05$) variation of lambing rate among different groups as showed in Table 4. While, born weight, weaning weight and number of lambs weaned were unaffected.

The daily body gain of lambs was increased with 15.6 and 4.04% than control in T1 and T2, respectively.

Progesterone levels in serum of ewes fed alfalfa:

Progesterone hormone levels in serum of experimental groups around the estrus day were showed in Table 5. The data showed that considerable variations ($P \leq 0.05$) among experimental groups, where T2 had the highest concentration of Progesterone than the T1 and control groups at the 3rd day before the estrus day, and values recorded 0.439, 0.375 and 2.21 ng/ ml of ewe serum in groups of control, T1 and T2, respectively. While, other days were insignificantly affected. This result has been demonstrated by Johnston, (2003) who noticed that Phytoestrogens may affect the bioavailability of sex hormones by binding or stimulating the synthesis of sex hormone binding globulin (SHBG).

CONCLUSION

It could be concluded that the use of alfalfa as green forage in ewes' nutrition caused reduction in reproductive efficiency and it is recommended that the maximum adding of fresh green alfalfa should not

exceed 30% of the total nutrient requirements on dry matter basis in ewe's rations especially around mating stage.

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دراسة تأثير استخدام البرسيم الحجازي في علائق الأغنام على الكفاءة الغذائية والأداء التناسلي

عمرو رجب العزب إبراهيم الجداوي^١، أحمد أحمد عثمان^٢، محمد محمد عوض^٢، محمد فتحي السائس^٣

^١ مشروع تطوير النظم الزراعية بالإسماعيلية، مركز البحوث الزراعية.

^٢ قسم الإنتاج الحيواني، كلية الزراعة، جامعة قناة السويس.

^٣ معهد بحوث الإنتاج الحيواني، مركز البحوث الزراعية.

في هذه الدراسة تم إجراء ثلاث تجارب لدراسة تأثير تغذية البرسيم الحجازي مع حبوب الذرة على الكفاءة الغذائية والأداء التناسلي في النعاج. وقد أجريت التجربة الأولى في محطة البحوث الزراعية بالإسماعيلية لدراسة كفاءة علائق التغذية باستخدام تقنية اكياس النايلون في الكرش لتقدير معدل اختفاء مادة العلف داخل الكرش. وقد أجريت التجربة الثانية على ٥١ نعجة بلدي (١٧ نعجة/ معاملة). بينما أجريت التجربة الثالثة على تسع نعجات تم اختيارها من التجربة الثانية بعد الولادة وطاقم الحملان (٣ نعاج/ معاملة). لدراسة تأثير تغذية البرسيم الحجازي على مستوى هرمون البروجسترون حول يوم الشيعاء. التجربة الثانية والثالثة تم إجراؤهم في محطة الإنتاج الحيواني بمشروع تطوير النظم الزراعية بشرق قناة السويس (سيناء) الإسماعيلية، مركز البحوث الزراعية، وزارة الزراعة.

العلائق المقدمة للحيوانات تم تقسيمها الى ثلاث علائق، العليقة الأولى (كنترول) مكونة من ٨٢% مخلوط العلف المركز و ١٨% تبن القمح كمادة مالئة. العليقة الثانية (التجريبية الأولى) تكونت من ٥٠% مخلوط علف مركز، ٣٠% برسيم حجازي اخضر، ٢٠% حبوب ذرة صفراء وذلك على اساس المادة الجافة. العليقة الثالثة (التجريبية الثانية) تكونت من ٦٠% برسيم حجازي اخضر، ٤٠% حبوب ذرة صفراء وذلك على اساس المادة الجافة خلال المراحل الفسيولوجية المختلفة للنعاج.

وقد اوضحت النتائج ما يلي:

١- ان معدل اختفاء البروتين الخام في البرسيم الحجازي كان مرتفع معنوياً عن مخلوط العلف المركز وحبوب الذرة خاصة عند اربع ساعات من التحضين في الكرش.

٢- وجود اختلافات معنوية في معدلات الخصوبة وانتاج الحملان بين الثلاث مجموعات التجريبية، حيث كانت معدلات الخصوبة ٦٠، ٣٦.٤، ١٨.٢%، وكانت معدلات انتاج الحملان ٦٠، ٣٦.٤، ١٥.٩% لكل من مجموعة الكنترول والتجريبية الاولى والثانية على التوالي. ولم توجد اختلافات معنوية لكل من معدلات التوائم والطاقم وكفاءة النعاج.

٣- كانت معدلات الزيادة اليومية في نمو حملان المجموعة التجريبية الاولى والثانية اعلى من الكنترول.

٤- لوحظ انخفاض تركيز هرمون البروجسترون في مجموعة الكنترول والتجريبية الأولى بينما ازداد التركيز معنوياً في المجموعة التجريبية الثانية كنتيجة لتأثير الفيتواستروجين الموجود في البرسيم الحجازي على النشاط الهرموني في النعاج.

وعليه نوصي بأن لا تزيد نسبة البرسيم الحجازي في علائق الأغنام عن ٣٠% على أساس المادة الجافة من الإحتياجات الغذائية الكلية، خاصة أثناء موسم التلقيح.