Studies on Using Sesbania Forage in Feeding of Growing Rabbit

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Abstract: Forty five growing male New Zealand White (NZW) rabbits aged five weeks and averaged 595.35gm body weight were used in the present study. Animals were allotted to three experimental groups (15 animals in each) with nearly equal average body weights, and were given either 100% concentrate feed mixture (CFM) ad-lib., considered the control (C); 80% CFM + sesbania forage ad-lib.,(T1) or 60% CFM + sesbania forage ad-lib.,(T2). The study was carried out for 8 weeks. The traits studied were growth performance, nutrients digestibility, nitrogen balance. The results showed that dry matter intake was 61.17, 60.58 and 58.66 as g / kg $W^{0.75}$ for C, T1 and T2, respectively. The results are indicated that the palatability did not affected by offering sesbania forage for rabbits. T1 and T2 had slightly higher in most nutrients digestibility. The high protein digestibility was associated with higher N-absorbed T1 and T2 than control diet. Also, results indicated that total protein level in plasma of rabbit consumed sesbania forage was slightly higher than that in the control group and increasing green forage in the ration improve the carcass quality. Therefore, rabbits fed on rations containing sesbania forage had the best economical efficiency compared to the control diet. Results of the study indicate that sesbania forage is a good source of protein and can be included in the ration of growing rabbits without adversely effects on growth performance, nutrients utilization and nitrogen balance.

Keywords: Sesbania forage; Growth performance; Digestibility; Rabbits.

INTRODUCTION

In the subtropical developing countries, like Egypt, the gap between available and required animal feeds is wide. Moreover, feed shortages are particularly acute with regard to protein requirements. On the other hand, green forage is cheap source for animal nutrition. The greenest forages in summer season are grasses which contained low percentage of crude protein. Attention was directed to unconventional feed sources such as sesbania as a potential source of protein to reducing feed shortages, decreases the cost of feeding and consequently the sale price of animal products Therefore, an attempts were carried to introduce some legumes which contained high protein source such as Sesbania for feeding goat (Soliman *et al.*, 1997). In addition to being excellent sources of protein, some of these green feeds are good sources of phosphorus, calcium, potassium and indigestible fibre (Cheeke, 1987; Fielding, 1991). This legume can tolerate wide temperature ranges, acidic soils and water logging, as well as soil salinity. *S. sesban* grows rapidly and is useful as fodder and green manure. Sesbania (*Sesbania Sesban*) as a summer legume contains a high protein source and its digestability more than 70% by small ruminants (Haggag *et al.*, 2000; El-Nahrawy and Soliman, 1998 and Singh *et al.*, 1980). The crude protein contents of Sesbania species are higher than those reported for conventional legumes, such as chickpea, mungbean and cowpea and Sesbania is generally a good source of essential fatty acids (Hossain and Becker, 2001).

The preset work was conducted to evaluate the nutritive values of Sesbania fed to rabbits with two levels of CFM (*80% CFM + sesbania forage ad-lib or 60% CFM + sesbania forage ad-lib.,*) and to investigate the effect of feeding different levels of CFM with Sesbania *ad lib* on performance of growing NZW rabbits.

MATERIALS AND METHODS

The present experiment was conducted in the Rabbitry Research Farm, College of Agriculture, Suez Canal University, Ismailia, Egypt. Sesbania (*Sesbania Sesban*) was cultivated at Ismailia Agricultural Research Station with five sowing date to obtain forage of the same height and age through the experiment periods. The normal recommended agronomic practices of forages were followed. The first cuts of green forages were done after about 60 days from planting.

Forty five male New Zealand White (NZW) rabbits at five weeks of age and average weight 595.35 gm were divided into 3 groups 15 rabbits in each. Animals in the first group were fed concentrate feed mixture CFM *ad lib.* And were considered the control group (C). animals of the 2nd group (T1) and 3rd group (T2) were fed either 80% or 60%, respectively, of the amount that was consumed by the first group in the previous week plus sesbania forage ad. Lib. Concentrates feed mixture CFM was formulated to meet or exceed the essential nutrient requirements of growing rabbits, according to NRC (1977). The chemical composition of concentrate feed mixture CFM and sesbania forage are shown in Table (1).

Rabbits were housed in individual hutches arranged in two rows of the rabbitry that has a concrete floor. It was designed to ensure cross ventilation and to protect the rabbits from rodents and other pests. Each rabbit was provided with a metallic feeder hanged at a reasonable height in the cage to prevent feed wastage. All rabbits were kept under the same managerial, hygienic and environmental conditions. Live body weight and feed consumption were recorded weekly during the experimental period.

Digestibility trails were carried out using five male rabbits from each experimental group at the beging of the nineth week of the feeding experiment hence they were transferred to metabolic cages. During the collection period of 5 days, total faeces voided were

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weighed, wrapped in aluminum foil and dried in an oven at 60° C until constant weight. The dried faecal samples were ground and stored for analysis. Proximate analysis of the diets, faeces and urine nitrogen were carried out according to the methods of AOAC (1990). Composite samples of daily urine (containing 10% H_2SO_4 solution) were collected from each animal over the collection period for nitrogen determination.

Carcass Characteristics: At the end of the feeding period (14 weeks), equal numbers of rabbits from each dietary treatment was randomly chosen to study the carcass traits. Rabbits were fasting for approximately 16 hours, individually weighed (to record the fasting weights) and thereafter slaughtered by severing the neck with a sharp knife according to the Islamic religion. The slaughtered weight (weight after complete bleeding) was recorded and instantly the head was separated. Skinning off was carried out by removing the skin including the tail and feet thereafter, the carcass was opened down and all entrails were removed. The lungs, liver, kidneys and heart were also removed and the rest of the body was weighed to determine the dressed weight.

Cecal trial: Seven days after the last cecotrophy control, the animals were slaughtered by cervical dislocation at the time of 18:30, to avoid the cecotrophy period. The gastrointestinal tract was removed and weighed. The stomach and cecum were weighed separately with and without their contents. The pH was measured in the cecal contents. Cecal content was immediately divided into two samples; one was dried at 80 °C and used to determine buffer capacity. The other sample was centrifuged at 2500 rpm for 10 min. The supernatant fluid was used to determine ammonia nitrogen (NH_3-N) and total VFA's concentration. A solution of 5% orthophosphoric acid plus 1% mercury chloride was added (0.1 mL/mL) to the samples for total VFA's determination. Samples for ammonia nitrogen determination were acidified with a solution of 0.2 M hydrochloric acid. The fluid pH values were immediately determined by a digital pH-meter. NH_3-N concentration was determined according to Conway (1957). Total volatile fatty acids (VFA's) were determined by the steam distillation method as described by Warner (1964) and fraction values of VFA were determined using KNAUER HPLC Pump 64. UV. Detector, column Rezex.

Blood Constituents: At the end of experimental period pooled blood samples were taken from all animals per each treatment to estimate serum protein, total lipids, and creatinine using reagent colorimetric methods., Aspartate aminotransferase (AST) and alanine aminotransferase (ALT), urea-N and albumin were also analyzed using assay kits supplied by Bio-Meriux (France) and Randox (England). The globulin values were obtained by subtracting albumin values from total protein values. Economical efficiency (Y). at the end of exprimental was calculated according to the following equation; [Y= {(A- B) / B} x 100], where A is the selling price of the obtained gain and B is the feeding cost of this gain.

Statistical analysis for all studied parameters was performed using the Statistical Analysis Systems (SAS, 1999). The linear mathematical model for the analysis comprised the effect of treatment as the sole source of variation (One-way analysis of variance). Significant differences among means were evaluated using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Growth performance:

Data in Table (2) indicated that, daily DM intake of rabbits fed control ration C was significantly ($P< 0.05$) higher than for T2 (60% CFM + Sesbania forage *ad lib)* but insignificantly higher than T1 (80% CFM + Sesbania forage *ad lib*). It was noticed that ration T2 decreased feed intake may be due to the bulky of its forage and increasing crude fiber. On the other hand, the average live weight of rabbit fed different levels of CFM and sesbania forage *ad lib.* were not significantly affected between C, T1 and T2. Whereas, T1 recorded the best values and T2 was the lowest one at 13th weeks. These results are in agreement with that, Obtained by Raharjo *et al.* (1986). The averages daily body gain of all treatment were not affected significantly. While, T1 showed the best value and T2 was the lowest one. Otherwise, the feed conversion revealed that no significant differences between all treatment while T1 recorded the best value than for C and T2. Although, the protein efficiency revealed that no significant differences between all treatment while C recorded the best value than for T1 and T2, these results are in agreement with those of Hossain and Becker, (2001). Generally from the data it could be seen that using sesbania forage with 80% CFM (T1) had improved live body weight, daily gain. While, using sesbania forage with 60% CFM (T2) had improved feed conversion these results are in agreement with those of Pote, *et al.*, (1980) and Rahatjo and Cheeke (1985).

Table (1): Average chemical analysis of concentrate feed mixture (CFM) and Sesbania forage fed to rabbits

Items	% Chemical composition						
	DM	OM	CP	CF	EE	NFE	ASH
Concentrate feed mixture CFM):							
As fed	90.45	84.94	15.79	11.70	3.52	53.93	5.51
DM basis	100	93.91	17.46	12.94	3.89	59.62	6.09
Sesbania forage							
As fed	18.31	16.78	4.55	3.89	0.58	7.76	1.53
DM basis	100	91.63	24.84	21.26	3.18	42.35	8.37

concentrate feed mixture (CFM) consisted of 26% wheat bran, 25% clover hay, 25% Yellow corn, 10% sunflower meal, 5% malt, 5% Soya bean meal, 2% molasses 1% limestone and 0.5% salt,0.5 % methionine.

Table (2): Growth performance of rabbits fed on different levels of CFM and Sesbania forage *ad lib.*

Items	Group1 control (C)	Group 2 (T1)	Group 3 (T2)
	100% CFM	80% CFM + Sesbania forage *ad lib*	60% CFM + Sesbania forage *ad lib*
daily dry matter intake (g)	$90.66^a \pm 0.11$	$90.24^a \pm 0.15$	$87.84^b \pm 0.12$
average live weight (g) at 5 weeks	598.63 ± 5.92	594.42 ± 5.72	592.67± 5.37
average live weight (g) at 13 weeks	1816.07 ± 21.35	1845.46± 19.24	1772.03± 22.14
average daily body gain (g)	21.74 ± 0.31	22.34± 0.32	21.06 ± 0.29
feed conversion (g feed/g gain)	4.18± 0.13	4.04 ± 0.09	4.17 ± 0.07
protein efficiency (g gain / g CP intake)	$1.37^a \pm 0.13$	$1.31^a \pm 0.17$	$1.17^b \pm 0.10$

a,b Means with different superscripts in the same row differ significantly ($P< 0.05$).

Digestibility and nutritive values:

Table (3) showed that the dry matter intake as $g/W^{0.75}$ of rabbits fed C was significantly ($P< 0.05$) higher than for T2 (60% CFM + sesbania *ad lib*), but insignificantly higher than for T1 (80% CFM + sesbania *ad lib*). Also, T2 showed the lowest values of feed intake. These results are in agreement with that obtained by Raharjo *et al.* (1986) and Hall, *et al.* (1975). From the data in Table (3), it was noticed that the digestibility of most nutrients was increased with increasing green forages (Sesbania forage) in the ration, may be due to decreasing DM intake of the rabbits. The OM and CF digestibilites of rabbits fed T2 ration were significantly (P<0. 05) higher than those fed C ration, also the CF digestibility of T2 ration was significantly (P<0. 05) higher than of T1 ration, while no significant difference of OM between T1 and T2 ration. The nutritive value as TDN of T1 and T2 was significantly ($P< 0.05$) higher than for C due to high values of digestibility of various nutrient of T1 and T2. The DCP took the same trend of TDN due to high value of CP digestibility. Regarding to N- balance, it noticed that, there were no significant differences among all treatments for N-intake among. Whereas, N- absorbed by rabbits fed T1 and T2 were significantly ($P< 0.05$) higher than for rabbits fed C and the same trend with N–balance., these results are in agreement with those of Hossain and Becker, (2001) and Pote, *et al.* (1980).

Caecum activity:

Caecum activity presented in Table (4) showed that, the pH values of caecal contents had no significant ($P<0.05$) and tended to be more acidic with increase the level of sesbania. The highest values of NH_3-N in caecal contents of rabbits fed the rations contained sesbania may be due the high precent of CP in sesbania and its digestibility. These results are in agree with that obtained by Ahn *et al.* (1989) and Kamatali *et al.* (1992) as they found high protein degradability of sesbania in the rumen was observed when compared with some other forages. Concerning to values of TVFA and acids percentages, there were significant differences ($P<0.05$) as shown in Table (4), the highest values 64.5 and 65.4 mmol/l caecum juices were recorded for rabbits given T1 and T2 but the lowest value 63.3 mmol/l caecum was for rabbits given C., the differences in concentrations of individual VFA may be due to many factors,the rate of production of this acid, the rate of its absorption, the rate of its utilization, the rate of its utilization by cacum or rumen microorganisms and finally to its conversion to other rumen or caecum metabolites as reported by Gray and Pilgim (1951).

Carcass characteristics:

Data presented in Table (5) showed no significant differences ($P<0.05$) of dressing percentage (DP %) values. By the way, rabbits consumed sesbania forage was slightly higher than that in the control group. Although, it could be seen that increasing green forage in the ration improve the carcass quality. These results are in agreement with that obtained by El- Abbady *et al.* (1979). On the other hand, The percentage values of full caecum %, full stomach %, and caecum length which not differed significantly ($P<0.05$) between treatments might be due to the quantity of fiber and its kind which had an effect on the transit time of digesta as recorded by Biondi, *et al.* (1996). Then the full weights of organs may be differed.The data showed non significant differences between treatments of head, heart and kidney wt. %.

Blood constituents:

Values of some blood constituents indicated that means of blood urea and creatinine were not significantly changed in rabbit groups consumed sesbania forage. Also, total protein, albumin, and globulin were insignificantly changed due to treatment (Table 6). Total protein level in plasma of rabbits consumed sesbania forage was slightly higher than that in the control group and in the meantime higher levels in AST and ALT enzymes in the treated groups. This could be due to increases of protein utilization and amino acids transamination in the tested groups. Urea and creatinine represent the two nitrogenous components that are eventually excreted by the kidney; therefore, changes in their levels in blood stream would reflect the insufficiency of kidney tubules or kidney malfunction. These results are in agreement with those of Bortolotti *et al*, 1989 and Habeeb *et al*, 1989.

Economical efficiency:

Data in Table (7) showed that the cost of total feed consumed decreased with increasing the level of sesbania forage in growing rabbit diets to compensate up to 40 % of the concentrate feed mixture CFM fed *ad lib.* Moreover, rabbit fed on diets containing sesbania forage had the best economical efficiency compared to the control diet.

Table (3): Dry matter intake, digestibility and nutritive values of rabbits fed different levels of CFM and Sesbania forage *ad lib*.

Items	Group1 control (C)	Group 2 (T1)	Group 3 (T2)
	100% CFM	80% CFM + Sesbania forage *ad lib*	60% CFM + Sesbania forage *ad lib*
Dry matter intake			
G / h / days	91.14 ± 1.17	91.47 ±1.18	89.75 ± 0.95
G / Kg w $^{0.75}$	61.17 ^{a} ± 1.72	60.58 ^{a} ± 1.84	58.66 ^{b} ± 1.37
Digestibility			
DM	63.47 ± 1.55	66.37 ± 1.16	67.17 ± 0.97
OM	65.42 ^{b} ± 1.53	69.43 ^{a} ± 1.24	69.46 ^{a} ± 1.67
CP	63.81 ± 6.92	67.74 ± 1.08	67.79 ± 0.96
CF	35.40 ^{b} ± 2.47	36.48 ^{b} ± 2.92	40.21 ^{a} ± 2.88
EE	71.02 ± 2.85	72.26 ± 3.22	70.76 ± 4.88
NFE	61.50 ^{a} ± 1.83	65.92 ^{b} ± 1.62	67.51 ^{b} ± 1.51
Nutritive value			
TDN	58.61 ^{b} ± 1.19	61.27 ^{a} ± 0.98	61.71 ^{a} ± 0.65
DCP	11.14± 0.24	12.83 ± 0.34	13.84 ± 0.59
Feed units intake, g / kg $^{0.75}$			
TDN	35.85 ^{b} ± 0.96	37.12 ^{a} ± 0.84	36.20 ^{b} ± 0.37
CP	10.68 ± 0.10	11.47 ± 0.04	11.97 ± 0.58
DCP	6.81 ^{a} ± 0.12	7.77 ^{ab} ± 0.14	8.12 ^{b} ± 0.10
N-balance			
N- intake g / h / d	2.55 ± 0.03	2.77 ± 0.04	2.93 ± 0.02
Faucal – N g / h / d	0.92 ± 0.04	0.89± 0.05	0.94 ± 0.03
Urinary–N g / h / d	0.71 ^{b} ± 0.07	0.75 ^{a} ± 0.04	0.72 ^{a} ± 0.05
Total excreted g / h /d	1.63 ^{b} ± 0.06	1.64 ^{a} ± 0.03	1.66 ^{a} ± 0.02
N-adsorbed g	1.62 ^{a} ± 0.02	1.88 ^{b} ± 0.03	1.99 ^{b} ± 0.04
N-balance g	0.91 ^{a} ± 0.60	1.13 ^{b} ± 0.02	1.27 ^{b} ± 0.01
N-balance %	35.92 ± 0.06	40.69± 0.04	43.24± 0.05

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

Table (4): Effect of feeding sesbania forage on caecum activity.

Items	Group1 control (C)	Group 2 (T1)	Group 3 (T2)
	100% CFM	80% CFM + Sesbania forage *ad lib*	60% CFM + Sesbania forage *ad lib*
pH	5.65	5.42	5.31
TVFA's (mmol/l)	63.3 ^{a}	64.5 ^{b}	65.4 ^{b}
$N\text{-}NH_3$, (mmol/l)	17.65	18.92	19.3
Acetic acid (%)	41.04 ^{a} ±0.44	46.39 ^{b} ±0.04	46.60 ^{b} ±0.99
Propionic acid (%)	31.47±0.72	31.95±0.68	32.10±0.79
Butyric acid (%)	18.47±0.54	19.95±0.79	20.36±0.55

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

Table (5): Effect of feeding sesbania forage on carcass characteristics.

Items	Group1 control (C)	Group 2 (T1)	Group 3 (T2)
	100% CFM	80% CFM + Sesbania forage *ad lib*	60% CFM + Sesbania forage *ad lib*
Live body wt.(gm)	1816.07	1845.46	1772.03
Carcass (%)	58.25	59.35	60.21
Liver (%)	2.18±0.15	2.55±0.13	2.79±0.15
Kidney (%)	0.73±0.02	0.75±0.01	0.69±0.07
Heart (%)	0.33±0.11	0.35±0.11	0.35±0.04
Head (%)	6.15±0.31	5.98±0.07	5.83±0.14
Dressing percentage (DP%)	61.14	62.24	62.84
Caecum (%)	5.83 ±0.68	5.14 ±0.25	5.63 ±0.31
Full stomach (%)	7.74 ±0.68	7.18±0.17	7.13±0.30
Visc. (%)	6.20±2.89	6.63±0.01	6.14±0.18
Caecum length (cm)	43.22±1.31	44.26±1.31	45.25±1.31

All means in the same row were not significantly different (P<0.05).

Table (6): Effect of feeding sesbania forage on biochemical parameters measured in blood

Items	Group1 control (C)	Group 2 (T1)	Group 3 (T2)
	100% CFM	80% CFM + Sesbania forage *ad lib*	60% CFM + Sesbania forage *ad lib*
Total Protein (gm/dl)	7.32± 0.82	7.64± 0.56	7.93± 0.72
Albumin (gm/dl)	3.39± 0.12	3.67± 0.07	3.81± 0.19
Globulin (gm/dl)	3.93± 0.55	3.97± 0.82	4.12 ± 0.75
Total Lipids (gm/dl)	3.20± 0.45	3.31± 0.72	3.32± 0.63
Urea (mg / dl)	75.80± 4.75	76.54± 6.65	76.85± 6.41
Creatinine (mg / dl)	0.65± 0.04	0.67± 0.12	0.68± 0.08
AST (IU / L)	190.70± 2.94	191.27± 6.4	191.70± 3.17
ALT (IU / L)	56.90± 1.52	57.6± 1.93	58.00± 2.53

All means in the same row were not significantly different ($P<0.05$).
AST= Aspartate amino transferase, ALT= Alanine amino transferase,

Table (7): Effect of feeding sesbania forage on rabbit farming income.

Items	Group1 control (C)	Group 2 (T1)	Group 3 (T2)
	100% CFM	80% CFM + Sesbania forage *ad lib*	60% CFM + Sesbania forage *ad lib*
Total feed intake kg/head (A)	5.10384	5.12232	5.026
Price / kg feed LE (B)	1.5	1.3	1.1
Total feed cost/head LE (A x B)/1000 (C)	7.66	6.66	5.53
Body weight gains kg/head (D)	1.21747	1.25098	1.17936
Price / kg body weight LE (E)	18	18	18
Total price / head LE (D x E)/1000 (F)	21.91	22.52	21.23
Income F - C (G)	14.26	15.86	15.70
Economic Ratio: income/feed cost G/C	1.86	2.38	2.84
Relative economic efficiency	100	127.96	152.69

Conclusively,

It can be concluded that sesbania is suitable as green feed for rabbits and its use helps to ensure increased growth rate and efficiency of use of the concentrated pellets fed. This will help to reduce the cost of rabbit production especially in many developing countries of the world such as Egypt where the costs of animal proteins and concentrate feeds are high.

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دراسة استخدام السيسبان كعلف اخضر في علائق الأرانب النامية

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أجريت هذه الدراسة باستخدام ٤٥ ذكر أرنب نيوزيلندي أبيض عمر ٥ أسابيع ومتوسط وزن ٥٩٥,٣٥ جم حيث وزعت هذه الأرانب علي ٣ مجاميع تجريبية ١٥ فى كل مجموعة علي أساس متوسط الوزن الحي بدون فرق معنوي بين المجاميع وتم تغذية هذه المجاميع كالأتي مجموعة المقارنة تم تغذيتها علي عليقة ١٠٠ % مركزة للشبع (C) و ٨٠ عليقة مركزة + السيسبان للشبع(T1) و٦٠ عليقة مركزة + السيسبان للشبع(T2). وكانت أهم النتائج المتحصل عليها هي كلأتي : وجد أن المادة الجافة المأكولة كانت ٦١,١٧، ٦٠,٥٨، ٥٨,٦٦ جرام / كجم $W^{0.75}$ في المجموعة ١، ٢، ٣ على التوالي مع قيم معاملات هضم جيدة لكافة المكونات الغذائية وكان ميزان النيتروجين موجب لكل المجموعات. أيضاً إرتفاع مستوى البروتين فى الدم مع زيادة مستوى السيسبان فى تغذية الأرانب بالإضافة إلى التحسن فى صفات الذبيحة.

وقد وجد أن زيادة مستوي السيسبان في تغذية الأرانب أدي إلي تحسن في وزن الجسم الحي ومعدل الزيادة اليومية في الوزن وكفاءة تحويل الغذاء والكفاءة الاقتصادية.

ومن ذلك ينصح عند تغذية الأرانب بإحلال جزء من المركزات بالسيسبان لما لها من تأثيرات جيدة علي مظاهر النمو والهضم والكفاءة الإقتصادية.