

EFFECT OF USING LUPIN SEED CONTAINING RATIONS ON SHEEP PRODUCTIVE PERFORMANCE

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SUMMARY

Two trials were conducted to evaluate the effect of four different sheep rations supplemented with 0, 15, 30 and 45% of sweet lupin seeds, respectively. The first trial dealt with the nutritive values of the tested rations, the second trial dealt with growing lambs performance (growth rate and feed conversion) as well as simple economical evaluation for the tested rations.

Results revealed that digestibility of nutrients and nutritive value of tested rations increased parallel with the increase of lupin seeds level from 15 to 45% in the ration (trial one). In the second trial, lambs performance was in favour of rations contained lupin seeds especially that contained 30% lupin seeds.

Keywords: lupin seeds, digestibility, lambs gain, feed conversion and economic evaluation.

INTRODUCTION

Animal feeding involves the use of several varieties of raw materials to produce complete balanced diets, capable of demand of the nutrient requirement of the animals. In addition, legumes as a source of plant protein are suitable crops of good potential in the Egyptian agriculture. Sweet lupin is one of this legumes that have low alkaloid content and appear to be also free from other anti-nutritional factors such as lectins, trypsin inhibitors and haemagglutinins and therefore offer the possibility of being a useful source of energy and protein (Guillaum *et al.*, 1987). Different studies showed that lupin seeds extremely palatable to sheep (May and Otterby, 1991) and contain high level of crude

protein and can be use as protein feed in sheep (Liu *et al.*, 1998). Also, lupin seeds are used extensively as a feed component for sheep increasing their live weight (Paduano *et al.*, 1995). Accordingly, the present study aimed to investigate the effect of adding sweet lupin seeds to the lambs diets on digestibility of nutrients, nutrient value, lamb performance, feed conversion rate, wool production and economic evaluation of the tested rations.

MATERIALS AND METHODS

The investigation was carried out at the experimental station of Sids Animal Production Research Institute, Agricultural Research Center, Egypt along with the laboratories of Animal Production Department, Faculty of

Agriculture, Fayoum Branch, Cairo University, through the period from September 2002 to December 2003.

Digestibility of nutrients and nutritive values:

Four digestibility trials were carried out to determine the digestibility of nutrients and nutritive values of the tested rations by using three Saidi rams in each digestibility trial including 14 days preliminary period followed by 7 days collection period. Animals were fed once daily at 9.00 a.m., water was allowed freely. The animals were healthy during the whole experimental period.

Feed and feces samples were analyzed by the conventional methods of A.O.A.C. (1980). Chemical composition of ingredients and rations, digestibility of nutrients and nutritive values of the tested rations were determined. Gross energy (GE, kcal/kg) of feeds was calculated according to Nehring and Haenli (1973).

Feeding trials, animals and treatments:

Twenty-four Saidi lambs with an average live weight of 20 kg at 4 months of age were divided into four similar groups (6 animals each). Animals were fed with experimental rations, their composition are presented in Table (1). The duration of the feeding trial was 170 days. The experimental rations were fed in calculated amounts to cover the nutrient requirements of growing sheep according to N.R.C. (1985), where the levels of lupin seeds in the rations were supplemented according to Kenney (1987). The daily portion offered to animals in two equal part at 9.00 a.m. and at 4.00 p.m. Fresh water was allowed freely and animals were healthy and under veterinary care. Body weight of lambs was recorded weekly before the morning feeding. Feed conversion was calculated and expressed in terms of DM and TDN (kg /kg body weight gain) and DCP (g/g body weight gain). Fleece

weight was determined at the end of feeding trial period. At the end of the trial simple economical evaluation was calculated as the price of one kilogram of rice straw, hay, concentrate mixture and lupin seeds which were 0.10, 0.50, 0.65 and 1.25 L.E., respectively, and price of one kg of live body weight was 10.0 L.E.

Statistical analysis:

Completely randomized design was used for the analysis of all trials. Least significant difference (LSD) was used when the treatment effect was significant (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Chemical composition of the feeds:

The proximate chemical composition of feed ingredients is presented in Table (2). Regarding the chemical composition of lupin seeds the obtained results indicated that the values of OM (96.05%), CP (39.43%) and EE (9.04%) were highest, while CF, NFE and crude ash content were the lowest among the feed ingredients. Similar results were observed by Karunajeewa and Bartlett (1985) for EE, Sgarbieri and Ganleazzi (1978), Oomah and Bushuk (1983) and Aguilera et al. (1985) for CF and Ballster et al. (1980), Aguilera et al. (1985) and Perez-Escamilla et al. (1988) for both of NFE and crude ash.

Chemical composition of the experimental rations with different levels of lupin seed (Table, 3) indicated that CP, EE and GE values were increased while CF, NFE and crude ash content tended to decrease with the increasing rate of lupin seed in lamb rations.

Digestibility of nutrients and nutritive values:

Results of the digestibility trials are summarized in Table (4). The results showed a remarkable improvement in

Table (1): Composition of the experimental rations on DM basis.

| Ingredient % | Rations# | | | |
|---------------|----------|----------------|----------------|----------------|
| | Control | R ₁ | R ₂ | R ₃ |
| Rice straw | 15 | 15 | 15 | 15 |
| Clover hay | 15 | 15 | 15 | 15 |
| Concentrate * | 70 | 55 | 40 | 25 |
| Sweet lupin** | - | 15 | 30 | 45 |

* Concentrate mixture composed of 42% undecorticated cottonseed meal, 30% yellow corn, 10% wheat bran, 10% rice bran, 3.5% molasses, 3% limestone, 1% common salt and 0.5% mineral mixture (macro and trace elements).

** Lupin seeds level was supplemented in the rations according to Kenney (1987) and Paduano et al. (1995).

#R₁ contained 15% sweet lupin seeds, R₂ contained 30% sweet lupin seeds and R₃ contained 45% sweet lupin seeds.

Table (2): Chemical composition of the experimental feed ingredients (on DM basis).

| Item | DM | Chemical composition % | | | | | | GE Mcal/kgDM |
|-------------|-------|------------------------|-------|------|-------|-------|-------|-----------------|
| | | OM | CP | EE | CF | NFE | Ash | |
| e straw | 38.78 | 81.39 | 2.83 | 1.64 | 38.45 | 38.47 | 18.61 | 3.71 |
| Clover hay | 89.37 | 86.57 | 14.52 | 1.71 | 30.30 | 40.04 | 13.43 | 4.06 |
| Concentrate | 90.79 | 90.75 | 16.54 | 3.51 | 13.86 | 56.84 | 9.25 | 4.33 |
| Sweet lupin | 91.52 | 96.05 | 39.43 | 9.04 | 13.19 | 34.39 | 3.95 | 5.13 |

Table (3): Chemical composition of the experimental rations (on DM basis).

| Rations* | DM% | Chemical composition % DM basis | | | | | | GE Mcal/kgDM |
|----------------|-------|---------------------------------|-------|------|-------|-------|-------|-----------------|
| | | OM | CP | EE | CF | NFE | Ash | |
| Control | 90.28 | 88.71 | 14.18 | 2.96 | 20.01 | 51.56 | 11.29 | 4.13 |
| R ₁ | 90.39 | 89.51 | 17.61 | 3.79 | 19.91 | 48.20 | 10.49 | 4.26 |
| R ₂ | 90.50 | 90.32 | 21.05 | 4.62 | 19.82 | 44.83 | 9.68 | 4.40 |
| R ₃ | 90.60 | 91.10 | 24.48 | 5.45 | 19.71 | 41.46 | 8.90 | 4.53 |

*R₁ contained 15% sweet lupin seeds, R₂ contained 30% sweet lupin seeds and R₃ contained 45% sweet lupin seeds.

digestibility of nutrients and nutritive value of rations as lupin seed levels increased from 0 to 45% in lambs diets. The same trend was observed by Standford *et al.* (1996) when they compared white lupin, canola, rapeseed meal and soybean meal in iso-nitrogenous rations. The digestibility of DM, OM, CP, EE and CF were significantly higher in lambs groups fed rations contained 30% and 45% lupin seed than those fed rations with 0% (control) or 15% lupin seed. However NFE digestibility did not show any significant differences among the different treatments. Also, no significant differences was found in the digestibility of nutrients between lambs groups fed rations containing either 30% or 45% lupin seed. As expected digestibility coefficients of DM, OM, CP and CF were improved as the protein content increased in the ration especially with R₂ (30% lupin seed) and R₃ (45% lupin seed).

Results of the nutritive values expressed as TDN %, SV %, DCP% and DE (Mcal/kg DM) as shown in Table (5) were tended to increase as the level of lupin seed increased in the ration. Energy values of the rations were nearly similar when lupin seed were included in the rations at 30 and 45% level. Those level showed higher nutritive values as it was found in lower levels (0 and 15 %). Protein nutritive values (DCP%) tended to increase significantly ($p \leq 0.01$) as the level of lupin seeds increased in the rations.

The results of digestibility trials may reflect the obtained results of the nutritive values of rations. Moreover, such results could be interpreted partly through the following studies. In earlier study by Teleni *et al.* (1989) reported that propionate production in the rumen increased when lupin was included in the ration. They cleared that this means that

glucose production increased to a great extent due to lupin supplementation. Leng *et al.* (1967) suggested that up to 39% of propionate produced in the rumen is converted to glucose.

Growth performance:

Data in Table (6) clearly indicated that lupin seed inclusion in lambs ration significantly ($p \leq 0.05$) improved the body weight of lambs and their average daily weight gain as compared to the controls. There were about 20.63%, 32.80% and 32.41% improvement in daily weight gain (g/h/d) in groups fed rations contained 15, 30 and 45 % lupin seed, respectively, compared to lambs in the group fed control ration.. The results of present study are in agreement with the findings of some previous studies by Holmes *et al* (1991) and Edward *et al* (1987). Otherwise there were no statistical differences among the live weight of lambs fed diets containing 15, 30 and 45% lupin seed.

Feed conversion rate (Table, 6) showed that no significant differences were found between groups fed rations contained 15, 30 and 45 % lupin seed (R₁, R₂ and R₃) in the regard of DM and energy. Such rations cleared the best feed conversion rate as compared to the control ration. The feed conversion rate of DCP (g/g gain) indicated that R₁ (ration contained 15% lupin seed) was the best among the groups. Such trend was also observed by Standford *et al.* (1996).

Fleece production:

Results showed that fleece weight (Table, 7) tended to increase as the level of lupin seeds increased in the ration from 0 to 30% and decrease with the 45% lupin seed level. Such results indicated that 30% lupin seed showed the best level of lupin in the rations on daily wool growth. Different studies showed the positive effect of lupin seed in

Table (4): Digestibility coefficients % of the lupin seed containing rations.

| Rations* | Digestibility coefficients % | | | | | |
|----------------|------------------------------|--------------------|--------------------|--------------------|--------------------|-------|
| | DM | OM | CP | EE | CF | NFE |
| Control | 65.00 ^B | 67.72 ^B | 68.30 ^C | 83.69 ^b | 45.51 ^C | 72.22 |
| R ₁ | 68.18 ^B | 70.72 ^B | 73.05 ^B | 88.56 ^a | 55.55 ^B | 74.69 |
| R ₂ | 75.89 ^A | 78.63 ^A | 82.54 ^A | 89.78 ^a | 68.81 ^A | 79.95 |
| R ₃ | 76.73 ^A | 79.38 ^A | 83.78 ^A | 89.15 ^a | 71.97 ^A | 78.98 |
| SE | 1.436 | 1.415 | 1.131 | 1.148 | 1.403 | 1.953 |

Average per each item in the same column with different superscripts are different ($P \leq 0.05$) for a and b; ($p \leq 0.01$) for A, B and C.

*R₁ contained 15% sweet lupin seeds, R₂ contained 30% sweet lupin seeds and R₃ contained 45% sweet lupin seeds.

Table (5): Nutritive values of the experimental rations.

| Rations* | Nutritive values % | | | |
|----------------|--------------------|--------------------|--------------------|-------------------|
| | SV | TDN | DCP | DE* Mcal/kg DM |
| Control | 54.58 ^B | 63.21 ^B | 9.71 ^D | 2.76 ^C |
| R ₁ | 58.60 ^B | 67.55 ^B | 12.93 ^C | 2.99 ^B |
| R ₂ | 66.94 ^A | 76.27 ^A | 17.48 ^B | 3.43 ^A |
| R ₃ | 68.85 ^A | 78.47 ^A | 20.64 ^A | 3.57 ^A |
| SE | 1.488 | 1.503 | 0.306 | 0.067 |

Average per each item in the same column with different superscripts are different ($P \leq 0.01$).

*R₁ contained 15% sweet lupin seeds, R₂ contained 30% sweet lupin seeds and R₃ contained 45% sweet lupin seeds.

Table (6): Effect of the experimental rations on growth performance of lambs

| Items | Control | R ₁ | R ₂ | R ₃ |
|------------------------------|---------------------|---------------------|---------------------|---------------------|
| Average initial weight (kg.) | 19.83 | 19.03 | 20.17 | 20.17 |
| Average final weight (kg.) | 42.42 ^b | 47.08 ^{ab} | 50.17 ^a | 50.08 ^a |
| Total weight gain (kg.) | 22.59 ^b | 27.25 ^a | 30.00 ^a | 29.91 ^a |
| Daily weight gain (g. / day) | 132.88 ^b | 160.29 ^a | 176.47 ^a | 175.94 ^a |
| Average daily intake: | | | | |
| DM (kg.) | 1.054 | 0.896 | 0.848 | 0.837 |
| SV (kg.) | 0.575 | 0.525 | 0.568 | 0.576 |
| TDN (kg.) | 0.666 | 0.605 | 0.647 | 0.657 |
| DE (Mcal.) | 2.909 | 2.679 | 2.909 | 2.988 |
| DCP (g.) | 102.23 | 115.85 | 148.23 | 172.76 |
| Feed conversion: | | | | |
| DM/gain (kg./kg.) | 7.93 ^a | 5.59 ^b | 4.81 ^b | 4.76 ^b |
| SV /gain (kg./kg.) | 4.33 ^a | 3.28 ^b | 3.22 ^b | 3.27 ^b |
| TDN/gain (kg./kg.) | 5.01 ^a | 3.77 ^b | 3.67 ^b | 3.73 ^b |
| DE/gain (Mcal.) | 21.89 ^a | 16.71 ^b | 16.48 ^b | 16.98 ^b |
| DCP/gain (g./g.) | 0.77 ^b | 0.72 ^b | 0.84 ^{ab} | 0.98 ^a |

Averages per each item in the same row with different superscripts are different ($p \leq 0.05$). *R₁ contained 15% sweet lupin seeds, R₂ contained 30% sweet lupin seeds and R₃ contained 45% sweet lupin seeds.

Table (7): Effect of the experimental rations on fleece weight and daily wool growth.

| Rations* | Fleece weight (kg.) | Daily wool growth (g.) |
|----------------|---------------------|------------------------|
| Control | 0.997 ^C | 4.15 ^C |
| R ₁ | 1.132 ^B | 4.72 ^B |
| R ₂ | 1.215 ^A | 5.06 ^A |
| R ₃ | 1.138 ^B | 4.74 ^B |
| SE | 0.049 | 0.285 |

Averages per each item in the same column with different superscripts are different ($P \leq 0.01$). *R₁ contained 15% sweet lupin seeds, R₂ contained 30% sweet lupin seeds and R₃ contained 45% sweet lupin seeds.

Table (8): Economic evaluation of the experimental rations for growth performance.

| Item | Control | R ₁ | R ₂ | R ₃ |
|---|---------|----------------|----------------|----------------|
| Total weight gain obtained (kg). | 22.59 | 27.25 | 30.00 | 29.91 |
| Consumed DM(kg) to produce total weight gain | 178.18 | 152.32 | 144.16 | 142.29 |
| Price of kg. DM of ration (pt.). | 60.37 | 70.26 | 80.11 | 89.95 |
| Feed cost (L.E)for total weight gain ¹ . | 107.56 | 107.02 | 115.49 | 127.99 |
| Total revenue (L.E) ² . | 225.9 | 272.5 | 300.0 | 299.1 |
| Profit above feeding cost ³ . | 118.34 | 165.48 | 184.51 | 171.11 |

¹Total weight gain kg x 10 (price of one kg weight gain), ²(2)-(1), R₁ contained 15% sweet lupin seeds, R₂ contained 30% sweet lupin seeds and R₃ contained 45% sweet lupin seeds.

different rations on wool growth (Ritchie *et al.*, 1999, Paduano *et al.*, 1995, Dixon *et al.*, 1998)

Economic evaluation:

The economic evaluation of the experimental rations for growing lambs is presented in Table (8). Results showed that total revenue and profit above feeding cost were the best with R₂ (30% lupin seed) followed by R₃ and R₁. From economical point of view, the 30% lupin seed supplemented ration (R₂) could be recommended.

CONCLUSION

Under the experimental conditions, ration contained 30 % lupin seeds (R₂) is more suitable for growing lambs, and it could be recommended from economical point of view.

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تأثير العلائق المضاف إليها بذور الترمس علي الأداء الإنتاجي للأغنام .

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تمت هذه الدراسة بكلية الزراعة جامعة القاهرة - فرع القويسم ومعهد بحوث الانتاج الحيوانى حيث اجرىبت تجربتين لتقييم أربعة علائق مضاف إليها بذور الترمس الحلو بمستويات (صفر، ١٥، ٣٠، ٤٥ %). استهدفت التجربة الأولى تقدير معاملات الهضم و القيم الغذائية للعلائق المختبرة و التجربة الثانية فكانت لدراسة تأثير العلائق المختبرة على الحملان النامية (معدل النمو وكفاءة التحويل الغذائى و انتاج الصوف) مع تقييم اقتصادى بسيط للعلائق المختبرة.

وأوضحت النتائج فى التجربة الاولى أن معاملات الهضم و القيم الغذائية للعلائق ارتفعت بزيادة مستوى بذور الترمس فى العليقة من صفر - ٤٥%. أما نتائج التجربة الثانية فقد أظهرت أن العلائق المضاف إليها بذور الترمس كانت افضل فى معدلات نمو وكفاءة تحويل للغذاء وخاصة العليقة المحتوية ٣٠% بذور الترمس و التى أظهرت أيضاً افضل النتائج من حيث وزن الجزة ونمو الصوف اليومى.

وتوصى الدراسة باستخدام العليقة المحتوية على ٣٠% بذور الترمس من وجهة النظر الاقتصادية وكذلك من ناحية معدل نمو الحملان و انتاج الصوف.