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in

Ranilla M.J. (ed.), Carro M.D. (ed.), Ben Salem H. (ed.), Morand-Fehr P. (ed.).  
Challenging strategies to promote the sheep and goat sector in the current global context

Zaragoza : CIHEAM / CSIC / Universidad de León / FAO  
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 99

2011  
pages 365-369

Article available on line / Article disponible en ligne à l'adresse :

<http://om.ciheam.org/article.php?IDPDF=801581>

To cite this article / Pour citer cet article

Abbeddou S., Hess H.D., Rischkowsky B., Kreuzer M. **Effects of local crop residues and agro-industrial by-products on milk yield and quality of Syrian Awassi ewes.** In : Ranilla M.J. (ed.), Carro M.D. (ed.), Ben Salem H. (ed.), Morand-Fehr P. (ed.). *Challenging strategies to promote the sheep and goat sector in the current global context.* Zaragoza : CIHEAM / CSIC / Universidad de León / FAO, 2011. p. 365-369 (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 99)



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# Effects of local crop residues and agro-industrial by-products on milk yield and quality of Syrian Awassi ewes

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**Abstract.** In order to test the effect of several feed replacement options available in Syria, an experiment with lactating ewes was conducted. Thus, six diets containing locally available crop residues (as experimental forages) and agro-industrial by-products (as experimental concentrate constituents) were tested in Syrian Awassi ewes for their effects on milk yield and quality. Diets had a forage: concentrate ratio of 0.3:0.7. The test feeds, constituting 30% of the diets, replaced control diet ingredients (forages: barley straw vs. olive leaves, lentil straw or Atriplex leaves; concentrates: wheat bran/cottonseed meal vs. olive cake or tomato pomace). Diets were designed to be isonitrogenous and isoenergetic using results of a previous digestibility experiment. Animals were group-fed with 2.5 kg dry matter/day and had *ad libitum* access to water. During 50 days, ewes were milked twice daily, and milk sampling and yield recording were done weekly. Data were subjected to ANOVA (effects: diet and time). Milk yield and composition changed with time, but did not significantly differ among treatments, except after 5 weeks with a higher milk fat content in the tomato pomace group (7.5%) followed by the olive cake group (7.4%). Even though not significant, a trend towards lower milk somatic cell counts for the olive cake group indicates a potential antioxidative activity. The results suggest that, when diets are nutritionally balanced, various alternatives can be applied successfully in ewe milk production.

**Keywords.** Awassi sheep – Agro-industrial by-products – Crop residues – Digestibility – Syria.

## ***Effets des résidus de récolte et des sous-produits agro-industriels locaux sur la production et la qualité du lait de brebis syriennes Awassi***

**Résumé.** Afin de tester l'effet de certains aliments non conventionnels en Syrie, une expérience sur des brebis allaitantes a été menée. Ainsi, six rations contenant des résidus de récolte locaux (constituant les fourrages expérimentaux) et des sous-produits agro-industriels (concentré expérimental) ont été testées, pour évaluer leur effet sur la production et la qualité du lait de brebis Syriennes de race Awassi. Les rations étaient constituées de 0.3:0.7 fourrage: concentré. Les aliments testés ont remplacé 30% des ingrédients du régime témoin (fourrages: la paille d'orge remplacée par les feuilles d'olivier, la paille de lentilles ou le feuillage d'Atriplex; concentrés: le son de blé/tourteaux de coton remplacé par les grignons d'olive ou la pelure de tomates). Les régimes ont été iso-azotés et iso-énergétiques en utilisant les résultats d'une expérience précédente de la digestibilité. Les animaux étaient nourris en groupe, avec 2,5 kg de matière sèche / jour et un libre accès à l'eau. Pendant 50 jours, les brebis étaient traitées deux fois par jour, et le contrôle du rendement en lait et son échantillonnage ont été effectués chaque semaine. Les données ont été analysées selon une ANOVA (effets: l'alimentation et le temps). L'évolution du rendement et de la composition du lait avec le temps, ne diffèrent pas significativement entre les traitements, sauf après cinq semaines, avec une plus grande teneur en matière grasse du lait pour le régime renfermant la pelure de tomates (7,5%), suivi par le groupe de grignons d'olive (7,4%). Bien que non significatif, une tendance à la baisse des cellules somatiques du lait pour le groupe grignons d'olive indique un potentiel d'activité antioxydante. Les résultats suggèrent que, lorsque les régimes sont nutritionnellement équilibrés, des solutions diverses peuvent être appliquées avec succès dans la production de lait de brebis.

**Mots-clés.** Brebis Awassi – Sous-produits agro-industriels – Résidus de récolte – Digestibilité – Syrie.

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## I – Introduction

Traditional feed resources are getting scarce because of rangeland degradation and increasing livestock size. Additionally, water shortage limits the livestock sector in dry areas. Beyond the need for alternative feeds to overcome the feed availability problems, knowing their direct effect on digestibility, meat and milk products and their nutritional value is of great importance. Studies realized so far, focused on the nutritional value of individual promising feed alternatives (e.g., Vasta *et al.*, 2008). In Syria, many options were already tested and applied, however many others are still underutilized. However, most of alternative feeds are likely to contain potentially anti-nutritional compounds like secondary metabolites, mainly tannins (olive leaves), or high salt content [saltbush (*atriplex*)], which reduce both their palatability and digestibility.

At the same time, many of these by-products are reported to be rich in ether extract, mainly linoleic and linolenic acid (Dell Valle *et al.*, 2007, Manunta *et al.*, 1981, Vasta *et al.*, 2008). According to Lock and Garnsworthy (2003), the type of lipid ingested is one of the main factors determining the fatty acid profile in milk even in ruminants where quite some biohydrogenation in the rumen takes place.

The objective of this study was to test the effect of diets containing underutilized local forages and agro-industrial byproducts on milk yield and quality of lactating Syrian Awassi ewes.

## II – Materials and methods

### 1. Animal and experimental design

The experiment was conducted at the International Center of Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria. Sixty 3-4 years old fat-tailed lactating Syrian Awassi ewes weighing on average  $51.0 \pm 6.5$  kg were kept indoors and divided into six homogeneous groups. Balancing criteria included, apart from body weight, days-in-milk ( $67.2 \pm 10.0$ ), milk yield, milk fat and protein contents.

Comparing the most available forage and concentrate alternatives in the dry areas has the limitation of not being able to separate between direct effects of the test feed and differences in protein or energy content. In the present study therefore, diets have been balanced for energy and protein based on the results of previous digestibility measurements (Abbeddou *et al.*, 2008). The six experimental diets were composed as follows (g/kg diet dry matter):

(i) Traditional diet: barley straw, 300; sugar beet pulp, 300; cottonseed meal, 200; wheat bran; 100, molasses, 100.

(ii) Olive leaves diet: olive leaves, 300; sugar beet pulp, 300; cottonseed meal, 100; wheat bran; 200, molasses, 100.

(iii) Lentil straw diet: lentil straw, 300; sugar beet pulp, 200; cottonseed meal, 200; wheat bran, 200; molasses, 100.

(iv) *Atriplex* foliage diet: *atriplex* foliage, 300; sugar beet pulp, 300; cottonseed meal, 100; wheat bran, 200, molasses, 100.

(v) Olive cake diet: barley straw, 200; olive cake, 300; wheat grain, 300; cottonseed meal, 100; molasses, 100.

(vi) Tomato pomace diet: barley straw, 300; tomato pulp, 300; sugar beet pulp, 50; wheat grain, 200; cottonseed meal, 50; molasses, 100.

During 50 days, 2.5 kg dietary DM/d were offered and water was available at *ad libitum* access.

On a weekly basis, daily milk yield was recorded and morning milk was sampled for laboratory analysis. Milk samples were either immediately analyzed for constituent composition or stored at -20°C until further analyses.

## 2. Laboratory analysis

Milk protein, fat, lactose contents were measured by the Milkoscan 133 B (Foss Electric, Denmark). The electro-conductivity, the pH and the density were analyzed on the same collection days by the pH meter (Hanna Instruments, Italy), the Microprocessor EC/TDS Meter (Hanna Instruments, Italy) and the density meter (PAAR, Austria) respectively. Caseins, protein N and acidity were evaluated in bulk samples across animals following the standard methods AOAC 927.03, AOAC 991.22 and AOAC 947.05 respectively. Data was subjected to analysis of variance considering diet and time with a model considering repeated measurements (SAS PROC GLM). Multiple comparisons among means were performed with Duncan's method.

## III – Results

The daily amount of feed offered was completely consumed by the ewes.

Starting from an average yield on day 0 of 1260±340 g/day, milk yield declined to 887±302 g/day in the seventh week of the experiment. This evolution was characterized by non-significant differences among the groups during the whole experiment period (Fig. 1). However, within groups, the traditional feed, the atriplex group and the lentil straw group presented a more stable milk yield over time, with a significant time effect not starting before the seventh week, respectively (significance not shown in figure). In the other groups yield decrease started to get significant earlier.

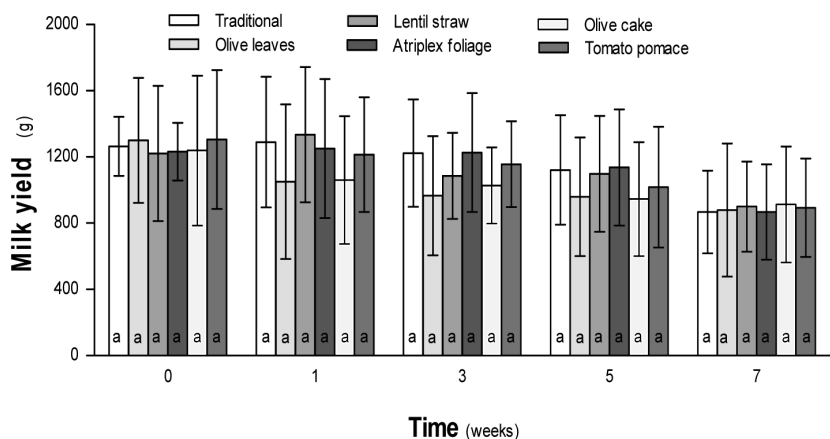


Fig. 1. Milk yield evolution when feeding the six different diets.

The fat content in milk started with 5.30±1.32% on day 0, representing the lowest fat content during the whole experimental period (Fig. 2). It increased and reached a maximum of 7.44±1.07% in the third week for the traditional group, which was not significantly different from the diets with atriplex (7.31±1.18%), olive cake (7.23±1.05%), olive leaves (7.16±1.20%) and lentil straw (6.79±0.89%) which did not significantly differ among each other. The tomato pomace group had the highest fat content in the fifth week with 7.5±1.2% followed by the olive cake group with 7.4±0.9% (not significantly different from the tomato pomace group).

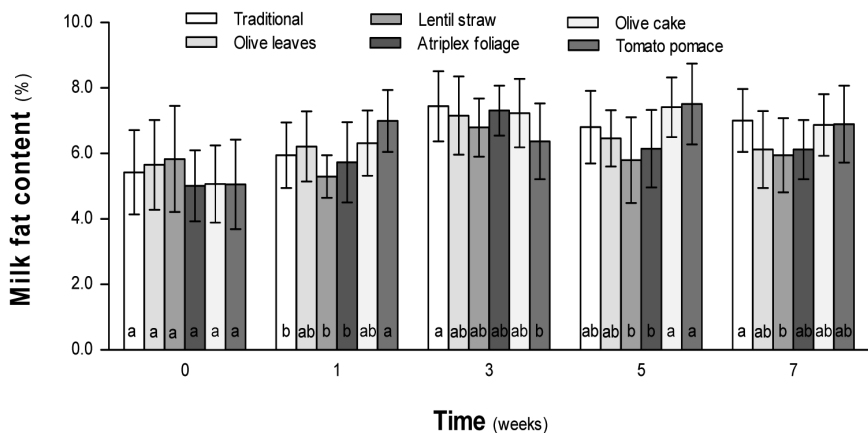


Fig. 2. Milk fat content evolution when feeding the six different diets.

The milk protein content tended to vary similarly with time as like the milk fat content (Fig. 3). It increased from day 0 to reach a maximum in the third week for the traditional feed group, the olive leaves and the lentil straw groups; and on the fifth week for the other three groups. The difference in milk protein content among groups was not significant except during the first and the third week (low for the tomato pomace group).

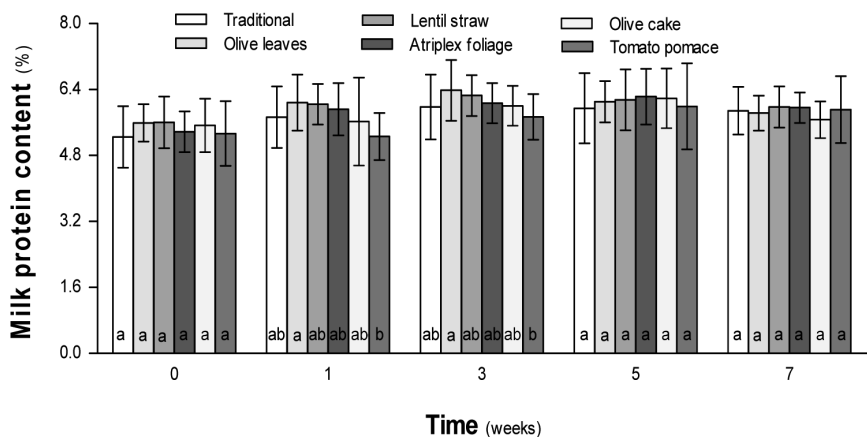


Fig. 3. Milk protein content evolution when feeding the six different diets.

Milk lactose content was more constant with time and across groups than the other milk constituents (Fig. 4). The difference was not significant among groups until the third week and disappeared again after the fifth week. In the third week, milk lactose content was higher for the tomato pomace group than for the olive leaves and the group receiving the traditional diet.

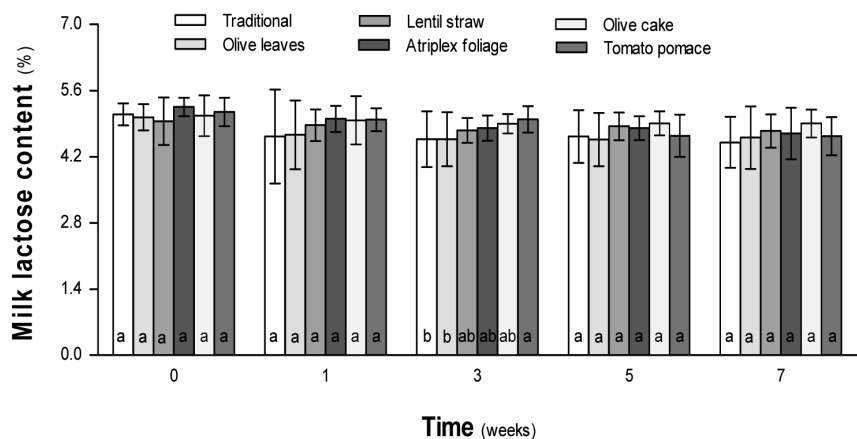


Fig. 4. Milk lactose content evolution when feeding the six different diets.

## IV – Discussion and conclusion

Although many studies have been performed about alternative feeds to straw and common concentrates, there is a clear lack of knowledge on the effect of such feeds on milk yield and its technological and nutritional quality, especially in fat-tailed dairy ewes. The outcome from these first results indicates that olive leaves and atriplex foliage did not depress the yield production and neither its fat and protein contents when offered in diets isonitrogenous and isoenergetic to a control diet. Both feeds contain high amounts of potentially anti-nutritive constituents like phenols for the olive leaves and tannins and minerals (Na) for the atriplex foliage. The same is true for the two agro-industrial by-products; olive cake and tomato pomace. While tomato pomace is at least rich in protein, olive cake was high in lignin suspected to reduce protein digestion. The present results indicated that also these two products could be used successfully if the energy and protein levels are balanced. Other milk traits, especially sensory attributes, should be analyzed.

## Acknowledgment

Our thanks to Dr. Safouh Rihawi for helping in designing the diets.

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