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# Nutritive value of *Melilotus officinalis* ecotypes from the North-western Moroccan pastures

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**Abstract.** Twenty ecotypes of *Melilotus officinalis* (L.) Pall. (yellow sweet clover) were collected from the Northwestern pastures of Morocco, and then cultivated in the experimental station of INRA in Tangier. The harvesting was realized during the vegetative, budding and flowering stages in order to study their nutritive value. The results indicate that nutritive value of *M. officinalis* depends significantly on the vegetative stage of sampling and the ecotype origin. From the vegetative to the flowering stage, the ash content decreases from 14.01 to 8.60% on dry matter (DM) (P<0.001), from 5.76 to 2.90% DM for ether extract or fat (FM), from 19.43 to 14.51% DM for crude protein (CP). However, the content of indigestible fibers increases significantly (P<0.001) from 3.50 to 6.65% DM for lignin (ADL). Otherwise, the content of nutritive value was very highly affected by the origin of ecotypes (P<0.001). They varied between 15.99% and 18.41%DM, 10.20% and 13.48% DM, 3.46% and 5.51% DM, 7.23% and 2.46% DM respectively for CP, ash, FM and ADL. Considering its adaptation to local environmental conditions of the north-west and its high nutritive value, the selected ecotypes of *M. officinalis* can contribute to improve the quality and quantity of proteins for animal breeding in the region.

Keywords. Melilotus officinalis - Moroccan ecotypes - Nutritive value - Pasture.

#### La valeur nutritive des écotypes de Melilotus officinalis des pâturages du nord-ouest marocain

**Résumé.** Une sélection de vingt écotypes de Mélilotus officinalis a été collectée des pâturages du Nord-Ouest du Maroc, puis cultivée dans la station expérimentale de l'INRA de Boukhalef. L'échantillonnage a été réalisé au stade végétatif, bourgeonnement et à la floraison afin d'évaluer leur valeur nutritive. Les résultats obtenus indiquent que la composition chimique de mélilot dépend strictement du stade de fauche et présente une diversité très hautement significative en termes de teneur en protéines, matière grasse, minéraux et en fibres. En allant du stade végétatif à la floraison, la teneur en minéraux (MM) diminue très significativement en passant de 14,01%MS à 8,60%MS, de 5,76%MS à 2,90%MS pour la matière grasse (MG), de 19,43%MS à 14,51%MS pour les protéines (MAT). En revanche, la teneur en fibres indigestible (lignine) augmente très significativement de 3,50%MS à 6,65%MS. Pour les écotypes, la teneur en protéines (MAT) varie entre 18,41%MS et 15,99%MS, 13,48%MS et 10,20%MS pour MM, 5,51%MS et 3,46%MS pour MG et entre 7,23%MS et 2,46%MS pour ADL. Vu son adaptation à la région du nord et sa haute valeur nutritive, cette espèce peut contribuer à l'amélioration de la qualité et la quantité protéique de l'offre alimentaire des élevages de la région.

Mots-clés. Melilotus officinalis – Écotype – Valeur nutritive – Pâturage.

# I – Introduction

Given the dearness of livestock's feed prices and the increase of the feed amounts needed for goats breeding, the identification and the evaluation of the nutritive value of new pastoral fodder species, which can be incorporated in goats feed ration, has become an important task to face the animal feeding requirements.

Yellow sweet clover (*Melilotus officinalis* L.) is an indigenous species, which grows spontaneously in the natural pastures of the North-western areas of Morocco. This legume plant can reveal a significant agro-economic and nutritional interest considering its availability in the area and its important content of proteins, phosphorus and calcium (Urness *et al.*, 1975).

The aim of this study was to better know the nutritive value of a collection of yellow sweet clover ecotypes in order to evaluate its fodder value for its valorization in the goat's food.

## II – Materials and methods

A collection of 20 ecotypes of *M. officinalis* from North Western Moroccan pastures were grown in the experimental field of Boukhalef (Tangier) on 13th November 2017. See Lahkim Bennani *et al.* (in this volume) for more information about the collection sites. Each ecotype was established on a plot of 10x2 m with 1m separation from each other. The plot was subdivided in 5 lines with a line space of 40 cm. Each line was sown with an amount of 10 g corresponding to a seed dose of 25 kg/ha. Approximately 2 kg of green matter was collected from each line in the vegetative (March12, 2018), budding (March 26, 2018) and flowering stage (April18, 2018) for each ecotype.

The experimental field of Boukhalef –Tangier– (35° 43' 49"N, 5° 25' 59"W) is located at an altitude of 30m. The climate is Mediterranean, with an average of temperature min and max of 2°C and 24°C, respectively. The total rainfall during the period of essay was 892 mm and humidity was between 76% and 81%. The soil is flat and heavy (black clay) with a very fine texture.

The samples of different ecotypes were dried at 60°C then grinded in 1 mm and analysed according to methods AOAC (1997). All the analysed components are reported on dry matter (DM) basis. The ash content was obtained according to method AOAC. The content of crude protein (CP) was evaluated according to the method of Kjeldhal. The fat content (FM) was extracted by using the method Soxhlet. The proportion of fibers (ADL) was carried out according to the sequential method of Goering and Van Soest (1975) with the fibre analyzer Ankom 200.

# III – Results and discussion

Variability of the studied parameters is very highly significant within the collection of the yellow sweetclover (Table 1, P<0.001).

The melilot seems to be rich in ash with an average content of 11.08% DM; results were higher than those found by Canbolat *et al.*, 2009. In fact, among the 20 studied ecotypes, E14, E23, E12, E17 and E11 recorded the most important contents (Table 1).

The CP content ranged from 15.99 % to 18.41 % DM. E23, E16, E34, E 11, E19, E18 ecotypes contain high CP content with 18% DM (Table 1). However, Canbolat *et al.* (2009) found a lower content, in order of 15.91%DM.

Concerning lignin's content, we note a significant difference between ecotypes but doesn't generally exceed 7.23% DM (Table 1). Yellow sweet clover is also described as a medium energy forage since the average content was 4.18% in FM and remains less than 5.5%. The majority of ecotypes was characterized by an FM rate ranging from 3.5% to 4.5%.

TAs shown in the Figure 1 below, all the studied parameters are affected very significantly with the advance of the stages (P<0.001).

The parameters Ash and, FM follow the same pattern with the advance of the stages. A respective reduction was noticed from 14.01; 5.76% recorded at the vegetative stage, to 8.60; 3.01% at the flowering stage.

Ecotype	Ash	FM	СР	ADL
E1	10.34 <sup>hi</sup> ±0.41	4.47 <sup>e</sup> ±0.61	17.79 <sup>bcd</sup> ±0.30	6.36bc±0.51
E2a	10.34 <sup>ghi</sup> ±0.95	3.48 <sup>l</sup> ±0.25	16.09 <sup>hi</sup> ±0.70	7.23 <sup>a</sup> ±0.74
E2	10.40 <sup>ghi</sup> ±0.61	4.59 <sup>d</sup> ±0.54	16.42 <sup>fgh</sup> ±0.74	6.08 <sup>cd</sup> ±0.71
E3	10.82 <sup>fghi</sup> ±0.63	4.10 <sup>g</sup> ±0.55	17.55 <sup>d</sup> ±0.64	5.57 <sup>def</sup> ±0.57
E34	10.29 <sup>hi</sup> ±0.42	4.13 <sup>g</sup> ±0.35	18.08 <sup>ab</sup> ±0.19	6.85 <sup>ab</sup> ±0.21
E9	10.38 <sup>ghi</sup> ±0.46	4.57 <sup>d</sup> ±0.63	17.62 <sup>cd</sup> ±0.77	5.37 <sup>cde</sup> ±0.85
E10	10.20 <sup>i</sup> ±0.64	4.31 <sup>f</sup> ±0.43	17.69 <sup>bcd</sup> ±1.05	6.39 <sup>bc</sup> ±1.05
E11	11.60 <sup>cde</sup> ±1.22	4.36 <sup>f</sup> ±0.51	18.03 <sup>abc</sup> ±1.30	4.99 <sup>fg</sup> ±0.88
E12	11.99 <sup>bc</sup> ±1.40	3.88 <sup>h</sup> ±0.23	16.65 <sup>efg</sup> ±0.78	5.17 <sup>efg</sup> ±0.31
E13	11.16 <sup>defg</sup> ±1.07	3.58 <sup>j</sup> ±0.23	16.24 <sup>ghi</sup> ±0.96	5.03 <sup>i</sup> ±0.71
E14	13.48 <sup>a</sup> ±1.12	3.48 <sup>k</sup> ±0.21	16.34 <sup>fghi</sup> ±0.68	4.82 <sup>i</sup> ±0.44
E15	11.45 <sup>cde</sup> ±0.76	3.76 <sup>i</sup> ±0.14	16.71 <sup>ef</sup> ±0.22	5.55 <sup>def</sup> ±0.85
E16	11.24 <sup>cdef</sup> ±0.69	4.30 <sup>f</sup> ±0.26	18.24 <sup>a</sup> ±0.91	2.46 <sup>k</sup> ±0.37
E17	11.85 <sup>bcd</sup> ±1.49	3.80 <sup>i</sup> ±0.23	15.99 <sup>i</sup> ±0.80	2.93 <sup>jk</sup> ±0.29
E18	10.57 <sup>fghi</sup> ±0.47	4.14 <sup>g</sup> ±0.21	18.01 <sup>abc</sup> ±0.81	4.95 <sup>fg</sup> ±0.67
E19	11.36 <sup>cdef</sup> ±0.71	5.51 <sup>a</sup> ±0.97	18.02 <sup>abc</sup> ±0.41	3.07 <sup>jk</sup> ±0.39
E20	10.36 <sup>ghi</sup> ±0.88	4.71 <sup>c</sup> ±0.92	17.56 <sup>d</sup> ±1.07	3.60 <sup>ij</sup> ±0.15
E21	11.06 <sup>defgh</sup> ±0.68	4.86 <sup>b</sup> ±0.93	17.48 <sup>d</sup> ±0.91	4.66 <sup>gh</sup> ±0.34
E22	10.29 <sup>hi</sup> ±0.64	3.46 <sup>k</sup> ±0.03	16.79 <sup>e</sup> ±1.16	4.06 <sup>hi</sup> ±0.31
E23	12.47 <sup>b</sup> ±1.16	4.30 <sup>f</sup> ±0.31	18.41 <sup>a</sup> ±1.26	2.82 <sup>k</sup> ±0.33
Signif.	***	***	***	***

Table 1. Chemical composition (%DM) of a collection *M. officinalis* ecotypes (average of stages ± stdrd)

The CP reaches the maximum level at the vegetative stage with 19.43%. As for all the other parameters, the content of proteins decreases significantly while the plants grow. The low levels were obtained at the flowering stage with an average of 14.51%. Lignin increases gradually with the plant's growth but remains generally moderate (6.65%) (Fig. 1).



Fig. 1. Chemical composition (%DM) of *M. officinalis* with stage of plant growth.

The contents obtained from FM, CP and MM were largely higher than those found by Canbolat *et al.* (2009). They reported respective contents of 1.99%, 15.91% and 6.98%. The same authors found a higher content of lignin with 12.74%.

In comparison with other fodder plants which are characterized by their interesting nutritive value, the species *Trifolium repens* recorded at the flowering stage a lower contents of CP and FM with about 15.08%DM, 3.29%DM respectively (Kiraz., 2011). Boualil (1983) reported that the alfalfa is very rich in CP with an average content of 19.0% and little lignified with 6.3% for ADL.

Rohweder *et al.* (1978) set up a standard based on laboratory analyses for the evaluation of the forage's quality. This standard revealed that the quality of fodder having a content of CP higher than 19% proves to be excellent, content between 17 and 19% is classified like very good, the quality of fodder is regarded as good if the content of CP ranges between 14 and 16%.

All the ecotypes can be considered as a very good quality, except E17. Concerning the effect of the growth stage on the nutritive value, it decreased significantly, nevertheless, these ecotypes can be classified of excellent quality at the vegetative stage, very good at the budding stage and good quality at the flowering stage.

# **IV – Conclusions**

The North Western Moroccan ecotypes of *M. officinalis* have a very significant diversity in terms of protein content, fat content, mineral content and fibers.

This study revealed that the nutritive value varies considerably according to the ecological origin of the ecotype and the growth stage. The vegetative stage followed by the budding stage were richer in nutrients, and thus are most suited to foddering. The ecotypes E23, E16, E34, E11, E19 and E18 showed the most interesting protein values, fat content, as well as a low content of ADL.

Considering its adaptation to the North-West of Morocco, its high forage production (Lahkim Bennani *et al.* in this volume) and its high feeding value, this species can contribute to improve quality and protein's amount of the animal diet. However, more studies are needed in order to develop the best sward management and it's fully valorization in the farming systems.

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