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# The nutritional characteristics of two forage legumes *Medicago scutellata L* and *Lotus ornithopodioides L*

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**Abstract**
Algeria is a country of breeding small ruminants par excellence. The cultivation of legumes is presented as a sustainable economic alternative to imported soybean meal. It is essential to know their specificities in order to make the best use of them within a high-performance ration. The species *M scutellata L* is earlier than *Lotus ornithopodioides L*. Medisl pods begin to harden while *Lotus ornithopodioides L*. is in the early stages of pod formation. The hay yield per square meter is 150.5g / m² for *M scutellata L* and 204.52g / m² for *Lotus ornithopodioides L*. The pod yield per square meter is higher for *M scutellata*, 149g / m² and *Lotus ornithopodioides. L*. offers 84.44g / m². The pods are drier than the plant at senescence (hay). This will allow a good conservation of the pods with their seeds. The content of total nitrogenous matter (MAT) is far high in the pods compared to the hay that carries them, while in the seed coats, the content of this element approaches that of hay. *Lotus ornithopodioides L*. in hay provides an average MAT of 9.3% DM. In medics, the average nitrogen content of *M. scutellata L* hay is 10.16%. The MAT content of *M. scutellata* pods is 30.97% and the teguments 10.06%. So nitrogen is stored much more in the seeds than in the seed coats of the pods and hay. The fiber rate is high in both organs, the plant in the form of hay and the pods; but between the two genera *Lotus* and *Medicago*, the pods of *Medicago* have more fiber than the pods of the genus Lotus. This is explained by the presence of helices and fibrous spines in species of medicinals. The pods of *M. scutellata* record 27.63% of CB against 20.53% in the pods of *Lotus ornithopodioides L*. The hay of the latter species shows a higher rate of 38.62% DM. It can be deduced that grazing hay alone has low nutritional value (little nitrogen and more fiber). The presence of pods will improve it.

**Keywords:** forage legumes, hay, chemical composition, seed

## Introduction

Algeria is constantly looking for a successful cattle breeding program for the production of milk, of which the citizen is a major consumer.

If we refer to the Roman period, Algeria was rich in animal husbandry and rich in agricultural products. During the colonial period and from 1931, it was the breadbasket of France, rich in cereals, grape varieties, citrus fruits and breeding. Moreover in 1948 Laument spoke of the poverty of the range of plants used in forage crops, when the range could be very long and sufficiently made up of different plants to meet the most diverse conditions in the regions of the country.

Currently the range is smaller than can be offered to imported dairy cattle breeding with great nutritional needs?

Independence Algeria inherited the colonial farms. With the five-year agricultural plans (mechanization, import, fertilization) tried to produce; but without any protection, the opening to imports of species and breeds has caused the current loss: plant species and no breeding program, neither animal nor plant has been successful.

Improving fodder and diversifying fodder crops are two essential conditions if we want to develop animal production. Equally important, even urgent, is the third condition for satisfying the study of renovated or entirely new rotations, especially for regions such as Mitidja on which the development of livestock depends and requires a complete reorganization of fodder production.

According to Professor René DUMONT, it was from the great economic crisis of 1931 that the French fodder economy began to dominate that of cereals in the agriculture of the most advanced French peoples. The problem of the intensification of production and of the "necessary fodder revolution" was thus posed at that time.

No economic crises experienced by Algeria have engendered an agrarian revolution even less fodder. The farmer and the rancher are still waiting for the solutions generated by the oil. The natural meadows with their rich flora and fauna are disappearing at a frightening rate with the implantation of concrete.

The food autonomy of a farm is more and more necessary for the breeders in view of the increasing costs of concentrated feed. One solution to reduce the purchase of vegetable proteins certainly lies in the production of fodder which combines grasses (especially cereal stubble) and legumes. In addition, significant savings will be made on the nitrogen input station during the life of the fodder but also for the following crops.

The cultivation of legumes is therefore presented as a sustainable economic alternative to imported soybean meal.

Indeed, legumes such as alfalfa, lotus and vetches, thanks to their ability to fix atmospheric nitrogen in an assimilable form via the symbiosis that they achieve with bacteria of the genus Rhizobium, do not need nitrogen fertilization in pure culture. They are also rich in protein, calcium, sodium, magnesium

and perfectly complement the classic rations based on grasses, which are rich in energy.

Forage analysis is a tool that allows the breeder to best balance the ration of the animals according to their specific needs. This type of analysis also allows the farmer to better understand the defects and qualities of his fodder and thus to adapt his cultivation techniques to promote the production of quality fodder. Each fodder is unique and it is essential to know its technological specificities in order to make the best use of it within a high-performance ration.

Thus, this contribution is intended to be a summary of the various operations, both scientific and technical, to be followed for the two species of legumes to be mowed or grazed the most widespread in the region of Mitidja, namely Medicago scutellata and Lotus ornithopodioides.

## Materials and method

1. The INRAA M'hedi Boulem experimental farm

It is located in Algiers and has the following geographic coordinates: 36 ° 41'4.35"North and 3 ° 06'24.84"East and an altitude of 18.5m. The experimental set-up of the three years of experiments carried out on legumes is of the complete random block type with three repetitions. Take place in the open fields.

2. Plant material

The annuals of the genus Medicago and lotus (Lotus ornithopodioides and Medicago scutellata) studied are shown in table (1) as well as their origin.

**Table 1:** Origins of the studied species

| Populations | Code | Origins |
|---|---|---|
| *M scutelatta* | Sc | Mitidja |
| *Lotus ornithopodioides* | Lsor | Mitidja |

3. Soil analysis

Deep soils have varied profiles: arable land (TA), usually worked by cultivation instruments (20 to 30cm); inert soil (SI), layer not worked but exploited by the roots, of very variable depth; subsoil or bedrock (RM); rock whose disintegration and weathering gave rise to the soil (Soltner., 2005). The term topsoil can then designate the entire layer visited by the roots. The topsoil then encompasses a large part of the bedrock (Soltner., 2005).

The physico-chemical analysis of soil samples taken from the field of the experimental site before sowing at a depth of 20cm and 40cm gave a silty texture, rich in calcium, poor in nitrogen, organic matter, potassium and sodium.

4. The climate

The climate of M'hedi Boulem (Tables.2) is a sub-humid coastal climate characterized by a cold and humid winter and a hot and dry summer. For the year 2017 the rainy month is January, 244.6mm and the hottest month is August with an average of 27.1 ° C. The maximum temperature is recorded in July with 58 ° C and the minimum 1.1 ° C in February.

**Table 2:** Climate data for the 2016/2017 campaign

| Date | Average rainfall in mm | Average Temperatures in ° C | Min temperature | Max temperature |
|---|---|---|---|---|
| 2016-11-01 | 62,8 | 16,6 | 5,8 | 33 |
| 2016-12-01 | 101,4 | 13,4 | 5,4 | 21,4 |
| 2017-01-01 | 244,6 | 10,1 | 2,5 | 22,6 |
| 2017-02-01 | 15,2 | 13,6 | 1,1 | 24,8 |
| 2017-03-01 | 53,8 | 14,6 | 2,8 | 28,8 |
| 2017-04-01 | 19 | 16,3 | 6,2 | 32,1 |
| 2017-05-01 | 4,6 | 20,3 | 8,1 | 36,9 |
| 2017-06-01 | 2,2 | 24,6 | 13,3 | 36,8 |
| 2017-07-01 | 6,4 | 26,8 | 14,8 | 58 |
| 2017-08-01 | 1 | 27,1 | 15,6 | 39,9 |

5. Chemical analysis of the plant studied

The chemical analyzes are carried out in triplicate. They relate to dry matter, organic matter, mineral matter, total nitrogenous matter and fibers.

## Results and discussion

### Precocity

The species M scutellata is the earliest Lotus ornithopodioides. On May 3, 2017 (Photos) the pods of the medics begin to harden while Lotus ornithopodioides is at the beginning of pod formation. In full bloom, it is difficult to distinguish the two genera. When the pods of Lotus ornithopodioides are ripe, their number is so high that you can hardly see the stems of the plants.

**Fig 1**

**Fig 2**

*Lotus ornithopodioides in full bloom on 04/04/2017 Mscutellata in pod formation on 04/04/2017*

**Yields**

The hay yield per square meter in *Lotus ornithopodioides* is 204.52g / m² higher than the yield of *M scutellata* which offers 150.5g / m². The pod yield per square meter is higher in *M. scutellata* 149g / m² while *Lotus ornithopodioides* transcribes 84.44g / m². Considering the shape of the pods and the type of habit of the species studied, *M. scutellata* and *Lotus ornithopodioides*, the harvest is easily done, unlike other species of medics having a small size and thorny. Table (3) shows that the harvested pods of *M. scutellata* provide 33.93% seed and 64.12% seed coat. The pods of the species *Lotus ornithopodioides* provide 44.07% seed and 55.92% seed coat. Thus, in the studied species (of both genera) the rate of integuments is higher than the corresponding seed.

This plant fraction should not be neglected in feeding ruminants. Since it contains valuable nitrogenous material (Table 5).

Especially during the summer season when grazed fodder is scarce. However, a vitamin-mineral compliment is essential to balance the ration.

**Table 3:** Straw and seed yields of the two species *M scutellata* and *Lotus ornithopodioides*

| Samples | Pod weight in g / m² | Straw in g / m² | Seed yield g / m² | seed in% | Teguments in% |
|---|---|---|---|---|---|
| *M scutellata* | 441 | 150,475 | 149,43 | 33,93% | 64,42% |
| *Lotus ornithopodioides* | 191,58 | 204,52 | 84,44 | 44,07% | 55,92% |

**Chemical composition**

The pods are drier than the plant on senescence (hay). This will allow good preservation of the seed. The level of mineral matter (MM) is high to different degrees in the plant and in the pods in the two species. In the teguments, the rate of mineral matter is high compared to that of the pods (Table 5).

Arrigo (2012) [2], suggests a content of 10.1% mineral matter in *L corniculatus* in green whereas we found in the hay of *Lotus ornithopodioides* 6.81% DM (Table 4).

The total nitrogenous matter (MAT) content is far high in the pods compared to the hay that carries them, while in the seed coats the MAT content approaches that of hay. *Lotus ornithopodioides* hay yields an average of 9.30%. In green, Arrigo (2012) [2], found 22.5% but Wang *et al* (1996) [5] found 19.6% MAT this difference is due to the choice of the cutting stage. Another species of trefoil (L pedonculatus) records a content of 26.4% MAT (Waghn *et al*., 2002) [4].

So nitrogen is stored much more in the seed (the seeds) than in the seed coats of the pods and in the hay.

Indeed, the elements necessary for the germination of the seed are stored in the parenchyma of the cotyledons of the seeds and will be mobilized during the period when photosynthesis is not established. The latter will become established as soon as the first leaves appear.

The fiber rate (CB) is high in both organs, the plant in the form of hay and the pods; but between the two genera *Lotus* and *Medicago*, the pods of *Medicago* have more fiber than the pods of the genus *Lotus*. This is explained by the presence of fibrous helices in species of medics. *M. scutellata* pods record 27.63% CB against 20.59% in *L ornithopodioides* pods. The hay of the latter species has a higher rate of 38.1% DM which is very far from the value of green noted by Arrigo *et al* (2012) [2] 24.5%.

It can be deduced that grazing hay alone has low nutritional value (little nitrogen and more fiber). The presence of pods will improve it.

**Table 4:** Chemical composition of the straw of the two species *M scutellata* and *Lotus ornithopodioides*

| Samples | MS% | MM en %MS | MAT%MS | CB%MS |
|---|---|---|---|---|
| Hay *M scutellatta* | 88,37 | 8,93 | 10,16 | 36,21 |
| Hay *Lotus ornithopodioides* | 88,26 | 6,81 | 9,30 | 38,62 |

MM: mineral matter; MS:dry matter; MAT: total nitrogenous matter CB:crude fiber

**Table 5:** Chemical composition of pods and seed coats of the two species *M scutellata* and *Lotus ornithopodioides*

| *Echantillons* | *MS%* | *MM en% MS* | *CB%MS* | *MAT%MS* |
|---|---|---|---|---|
| *Pods M scutellatta* | *94,98* | *5,25* | *27,63* | *30,97* |
| *Pods Lotus ornithopodioides* | *94,98* | *5,25* | *20,59* | *39,51* |
| *eégument M scutellata* | *96,46* | *6,27* | *53,71* | *10,06* |
| *Tegument Lotus ornithopodioides* | *95,69* | *6,56* | *36,36* | *9,88* |

MM: mineral matter; MS: dry matter; MAT: total nitrogenous matter CB: crude fiber

**Conclusion**

The species *M scutellata* is the earliest *Lotus ornithopodioides*. When the pods of *Lotus ornithopodioides* are ripe, their number is so high that you can hardly see the stems of the plants.

The hay yield per square meter in *Lotus ornithopodioides* is greater than the yield of *M. scutellata*. But the pod yield of *M. scutellata* exceeds that of *Lotus ornithopodioides*.

By considering the shape of the pods and the type of the habit of the studied species, *M scutellata* and *Lotus ornithopodioides* the harvest is done easily unlike the other species of medics having a small size and presenting thorns. After stripping, the teguments show a very high rate in both species. This plant fraction should not be neglected in feeding ruminants. Since it contains a valuable chemical composition.

In the teguments the rate of mineral matter is high compared

to that of the pods. The total nitrogenous matter (MAT) content is far high in the pods compared to the hay that carries them, while in the seed coats the MAT content approaches that of hay. The fiber content (crude fiber: CB) is high in both organs, the plant in the form of hay and the pods; but between the two genera *Lotus* and *Medicago*, the pods of *Medicago* have more fiber than the pods of the genus *Lotus*. This is explained by the presence of fibrous helices in species of medicinals.

These technological specificities of the two species allow farmers and breeders to make the best use of them within a high-performance ration.

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