Research note: An observation on yield and nutritive value of
Sesbania aculeata and its feeding to Damascus does

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Abstract
An observation was made of dry matter production (whole plant) and nutrient composition of
Sesbania aculeata 4 months after planting. The material was fed as a supplement to Damascus
does for 23 days before mating and then through
to kidding.

Nutrient composition of S. aculeata (leaves +
twigs + stalks) was: CP 144, CF 341, CL 23,
NDF 562, ADF 435 and ADL 72 g/kg DM.
IVOMD was 50.7%, and energetic values were:
GE 28.27, ME 6.84 and NEL 3.50 MJ/kg DM.

Dry matter and CP yields of S. aculeata hay
were 8269 and 1190 kg/ha, respectively; and
energy yields were: GE 233 765, ME 56 560 and
NEL 28 942 MJ/ha.

Half of the does failed to produce kids. How-
ever, the liveweight and duration of pregnancy
(148.8 ± 1.5 d) of the remaining does, and birth
weight (4.6 ± 1.1 kg) and weaning weight (18.8 ±
5.0 kg) of the kids fell in the normal range.

The progesterone pattern before mating was
normal in all does and remained so in does that
had fertile matings; however, the pattern was
abnormal (acyclic) in those which were mated
but failed to conceive.

Further studies are needed to allay concerns
that feeding S. aculeata to breeding does may
cause problems with fertility.

Introduction
Forages from shrubs and trees such as Leucaena
leucocephala, Leucaena pallida, Sesbania sesban
(Kaitho et al. 1998), Sesbania grandiflora,
Albizia chinensis, Gliricidia sepium (Ash 1989)
and Sesbania aculeata (Khandaker et al. 1998)
are used as supplements to low quality diets.
Sesbania aculeata, a member of the Fabaceae
family, which is native to Pakistan and India, is
an annual or biennial legume, commonly grown
for the reclamation of salt-affected soils. It is a
fast-growing crop reaching, within a few months,
as height of about 3.5 m, and being a nitrogen-
fixing tree, is a useful green manure crop
(Qureshi and Barret-Lennard 1998).

Due to its good characteristics, S. aculeata has
been introduced into many countries in Asia
(Sisworo et al. 2000), Africa (Bar et al. 2000)
and South America (Dias et al. 1999). S. aculeata
was introduced into Syria in 1997 under an inter-
regional project mainly for green manure and
fodder production.

Despite the widespread use of S. aculeata as a
fodder supplement in some countries, there is no
information regarding the nutritive value of the
whole plant grown in arid and semi-arid zones
and its effects on the reproductive performance of
farm animals.

According to Wilson and Harrington (1980), it
is difficult to measure the amount of leaves pro-
duced by browse species, as it is influenced by
age of trees, defoliation and rainfall. Therefore,
the objectives of the present experiment were to
evaluate the yields and nutritional value of S. aculeata (whole plant: leaves, twigs, stalks)
and to feed it to Damascus does throughout the
reproductive cycle.

Materials and methods
Site description and planting
Seeds of S. aculeata were sown, by broadcasting,
in May 1999 at a rate of 80kg/ha at Der Al-Hajar
Research Centre, located about 33 km south-east
of Damascus (33°21’ N, 36°28’ E; elevation
617 m asl). This area, which is located in the dry
zone, has an annual rainfall of about 100 mm occurring mainly during December and January. Table 1 shows the characteristics of the soil prior to planting.

Plants were harvested in September 1999 at the beginning of pod formation, when they reached a height of about 170 cm. An area of 0.1 ha was sampled to obtain the yield estimate. Whole plants (leaves, twigs, stalks) were air-dried outdoors in full sun for a few days, chopped into lengths of 8 cm and thoroughly mixed to be used later as a feed supplement to the experimental Damascus does. Representative samples of the hay were taken, ground to pass through a 1 mm sieve, mixed and stored frozen in sealed nylon bags for subsequent analysis and evaluation.

Animal feeding and management

Twelve cycling Damascus does, 3–5 years of age and 52.2 ± 8.6 kg liveweight, were used. All does had no previous records of reproductive disorders.

Does were penned individually (except for the time the bucks joined does for breeding, without any access to feeding outdoors) and fed a ration of lentil straw and concentrates for 21 days, and thereafter, they were given 2 experimental rations containing different proportions of lentil straw, concentrates and *S. aculeata* hay. The rations were designed to meet the nutritive requirements of the does during the following stages: from 23 days before mating up to Day 105 of pregnancy, and from Day 106 of pregnancy until kidding. The quantity of *S. aculeata* hay fed was fixed at 300 g/doe/d. Water was provided *ad libitum*. There were no control animals, which received the basic diet without sesbania. The ration was offered daily at 08.00h and 14.00h. The daily amount of feed offered to does was all completely consumed, without any remains of feed on the following day.

Blood collection and progesterone analysis

Jugular blood samples (10 ml) were collected daily from the does (at 10.00h) from 3 weeks prior to feeding *S. aculeata* (to ascertain that does were cycling normally) to mating. Blood samples were then collected twice weekly until kidding. In the case of does that were mated but did not kid, twice weekly sampling of blood continued until 5 months after mating.

Blood was centrifuged at 3000 rpm for 20 minutes, and serum was stored at −20°C for progesterone analysis using validated FAO/IAEA progesterone RIA kits. Progesterone levels equal to or above 3.18 nmol/l were considered indicative of normal luteal function or pregnancy, and levels under 3.18 nmol/l were considered indicative of either anoestrous or the follicular or early luteal phases of the oestrous cycle (Zarkawi 1997).

Oestrus detection and mating

Two fertile Damascus bucks were released among the does outdoors after 23 days of *S. aculeata* supplementation, for 3 h twice per day (08.00–11.00h and 17.00–20.00h) for 3 weeks for oestrus detection and natural mating, with no access to feed. Thereafter, bucks were joined with the does daily from 08.00–13.00h for a further 6 weeks for mating of does that returned to oestrus after the first mating.

Methods and measurements

*In vitro* organic matter digestibility (IVOMD), metabolisable energy (ME) and net energy for

<table>
<thead>
<tr>
<th>Soil sample depth (cm)</th>
<th>0–20</th>
<th>20–40</th>
<th>40–60</th>
<th>60–80</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>8.6</td>
<td>8.6</td>
<td>8.6</td>
<td>8.7</td>
</tr>
<tr>
<td>EC (dS/m)</td>
<td>0.16</td>
<td>0.16</td>
<td>0.16</td>
<td>0.17</td>
</tr>
<tr>
<td>Organic matter (%)</td>
<td>0.82</td>
<td>0.65</td>
<td>0.50</td>
<td>0.39</td>
</tr>
<tr>
<td>Available P (ppm)</td>
<td>6.1</td>
<td>3.8</td>
<td>3.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Sand (%)</td>
<td>61.0</td>
<td>58.4</td>
<td>63.4</td>
<td>67.0</td>
</tr>
<tr>
<td>Silt (%)</td>
<td>25.1</td>
<td>26.0</td>
<td>24.2</td>
<td>22.2</td>
</tr>
<tr>
<td>Clay (%)</td>
<td>13.9</td>
<td>15.6</td>
<td>12.4</td>
<td>10.8</td>
</tr>
<tr>
<td>Total N (%)</td>
<td>0.089</td>
<td>0.078</td>
<td>0.064</td>
<td>0.050</td>
</tr>
<tr>
<td>Inorganic N (ppm)</td>
<td>29.1</td>
<td>39.6</td>
<td>40.1</td>
<td>41.7</td>
</tr>
</tbody>
</table>
Feeding sesbania to Damascus does

Lactation (NEL) of the feeds given to the experimental does were estimated by the methods of Menke et al. (1979). Gross energy (GE) was measured using a calorimeter (Haake HC10, Germany). Nutritive components (crude ash: CA; crude protein: CP; crude lipid: CL; crude fibre: CF) were evaluated using the procedures of Naumann and Bassler (1976); and neutral-detergent fibre (NDF), acid-detergent fibre (ADF) and acid-detergent lignin (ADL) were determined according to Goering and van Soest (1970).

Results and Discussion

Feed intake

Table 2 shows the daily intakes of feed ingredients in the rations given to the does.

Crop yield and nutritional value

Yields of dry matter (DM) and CP produced from S. aculeata in the 4 months following planting were 8269 and 1190 kg/ha, respectively, and the energy yields were: GE 233 765, ME 56 560 and NEL 28 942 MJ/ha.

Table 3 shows the nutrient composition and energetic values of the feeds given to the Damascus does. The CP concentration (14.4%) reported in our study (whole plant: leaves, twigs and stalks) for S. aculeata was lower than the 16.9% for S. sesban (leaves and twigs) reported by Karachi and Zengo (1998), and much lower than crude protein concentration in leaves of other Sesbania spp. e.g. 22.5% (Nsahlai et al. 1994), or 21.5% (Robertson 1988) in S. sesban; 24% (Khandaker et al. 1998) in S. aculeata; 28% in S. grandiflora (Serra et al. 1995); 28.1% in S. rostrata (Hossain et al. 2000).

Hossain et al. (2000) reported NDF and ADF concentrations in leaves of S. aculeata of 229 and 213 g/kg DM, respectively, GE and ME values of 20.18 and 8.83 MJ/kg DM, and IVOMD of 67%. NDF and ADF concentrations in our study were higher and digestibility and net energy values were lower because we used the whole plant of S. aculeata as compared with leaves. Levels of NDF, ADF and ADL are negatively correlated with digestibility of roughages (Minson 1982).

Serum progesterone levels and reproductive performance

Serum progesterone levels prior to S. aculeata supplementation were normal in all does, confirming that does used in the experiment were

Table 2. Daily intake of feed ingredients by Damascus does from rations fed from pre-joining to kidding.

<table>
<thead>
<tr>
<th>Feed ingredient</th>
<th>Intake CP</th>
<th>ME</th>
<th>NEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentil straw</td>
<td>1000</td>
<td>73.5</td>
<td>6.93</td>
</tr>
<tr>
<td>Concentrate</td>
<td>250</td>
<td>44.9</td>
<td>2.22</td>
</tr>
<tr>
<td>Total</td>
<td>1550</td>
<td>158.1</td>
<td>11.04</td>
</tr>
<tr>
<td>Lentil straw</td>
<td>1600</td>
<td>117.6</td>
<td>11.09</td>
</tr>
<tr>
<td>Concentrate</td>
<td>400</td>
<td>71.8</td>
<td>3.55</td>
</tr>
<tr>
<td>Total</td>
<td>2300</td>
<td>229.1</td>
<td>16.53</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feed ingredient</th>
<th>Intake CP</th>
<th>ME</th>
<th>NEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentil straw</td>
<td>930</td>
<td>193</td>
<td>263</td>
</tr>
<tr>
<td>Concentrate</td>
<td>920</td>
<td>76</td>
<td>144</td>
</tr>
<tr>
<td>Total</td>
<td>1850</td>
<td>269</td>
<td>407</td>
</tr>
</tbody>
</table>

1 CP: crude protein; ME: metabolisable energy; NEL: net energy for lactation.

Table 3. Nutrient composition1 (g/kg DM) and energetic values (MJ/kg DM) of the feeds given to Damascus does.

<table>
<thead>
<tr>
<th>Feed</th>
<th>DM</th>
<th>CA</th>
<th>CP</th>
<th>CF</th>
<th>CL</th>
<th>NDF</th>
<th>ADF</th>
<th>ADL</th>
<th>IVOMD</th>
<th>GE</th>
<th>ME</th>
<th>NEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentil straw</td>
<td>930</td>
<td>193</td>
<td>79</td>
<td>263</td>
<td>17</td>
<td>505</td>
<td>426</td>
<td>148</td>
<td>615</td>
<td>23.26</td>
<td>7.45</td>
<td>3.53</td>
</tr>
<tr>
<td>Concentrate</td>
<td>920</td>
<td>76</td>
<td>144</td>
<td>341</td>
<td>23</td>
<td>562</td>
<td>435</td>
<td>72</td>
<td>507</td>
<td>28.27</td>
<td>6.84</td>
<td>3.50</td>
</tr>
</tbody>
</table>

cycling normally. For all tested does, the serum progesterone levels of the does from the commencement of feeding up to mating remained at the pre-feeding levels. The serum progesterone pattern, from mating through to kidding in does that had fertile matings and successful pregnancy, was normal (Figure 1), and similar to that reported by Zarkawi (2000) in Damascus does. However, the progesterone pattern in those that were mated but failed to kid was abnormal (acyclic) (Figure 2). There was much more variation in serum progesterone levels in infertile than in fertile does at any observation.

The effect of feeding *S. aculeata* on the reproductive performance of farm animals has not been previously investigated. In the present experiment, all does exhibited oestrus and mated. Two does (17%) showed oestrus after the first mating and were remated. It is significant that 50% of the does did not kid but did not exhibit oestrus after the initial joining. Six does produced kids with no problems in delivery, and the kids born were healthy. Since all does were normal prior to feeding, it appears that inclusion of sesbania in the diet either prevented conception or caused early embryonic mortality in the 50% of does which did not kid. It then suppressed oestrus for the remainder of the observation. The mode of action is unclear.

The duration of pregnancy in does which kidded was $148.8 \pm 1.5$d (147-151d), which is similar to $149.0 \pm 3.6$d reported by Zarkawi and Al-Masri (1998) in Damascus does kept under the same conditions but receiving a ration free of *S. aculeata* and containing concentrates and wheat straw.

**Liveweight, birth and weaning weights**

Does that were mated and produced kids gained weight steadily from mating to kidding ($8.8 \pm 3.6$ kg), while does which failed to produce kids gained much less weight and performance was quite variable ($5.5 \pm 4.2$ kg). Cows supplemented

![Figure 1. Serum progesterone level (mean ± s.e.) in the blood of Damascus does fed supplementary *Sesbania aculeata* during the period extending from mating through to kidding.](image-url)
Feeding *Sesbania* to Damascus does

with *S. sesban* showed significantly higher body weights compared with their unsupplemented counterparts (Kumwenda 1999). In another study, Nsahlai and Umunna (1996) found no effect on liveweight of sheep fed *S. sesban* despite a higher oat hay intake.

The mean birth weight of kids born to the experimental does was 4.6 ± 1.1 kg (3.3–7.0 kg), and mean weaning weight was 18.8 ± 5.0 kg (15–31 kg). These results compare with the 4.7 ± 1.0 kg birth weight reported by Zarkawi and Al-Masri (1998) for kids born to Damascus does fed a similar ration without *S. aculeata* hay.

We are unaware of any other experiments on feeding of *S. aculeata* (whole plant) hay as a supplement to breeding does. As we did not maintain a control group which received the basal diet without *S. aculeata*, we can not draw any conclusions on its possible value as a supplement for reproducing goats. However, these preliminary data give some cause for concern. Further comparative studies are needed to examine the effect of *S. aculeata* supplementation on fertility of does and the threshold levels to feed to breeding Awassi ewes which are considered the most important small ruminants in Syria and in many other countries.

**Acknowledgements**

The authors thank the Director General and Head of Agriculture Department, Atomic Energy Commission of Syria, for their encouragement. This work has received some financial support from the International Atomic Energy Agency (IAEA).

**References**


![Figure 2. Serum progesterone level (mean ± s.e.) in the blood of Damascus does fed supplementary *Sesbania aculeata* for a period of 5 months after mating, which failed to produce kids.](image)

**Figure 2.** Serum progesterone level (mean ± s.e.) in the blood of Damascus does fed supplementary *Sesbania aculeata* for a period of 5 months after mating, which failed to produce kids.
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