Technical culture of kenaf produced under Tunisian semi arid conditions

Ammar H., Lahyeni M.A., Lahsoumi R., Ben Younes M., López S.

in

New approaches for grassland research in a context of climate and socio-economic changes

Zaragoza : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 102

2012
pages 173-176

http://om.ciheam.org/article.php?IDPDF=6874

To cite this article / Pour citer cet article


http://www.ciheam.org/
http://om.ciheam.org/
Technical culture of kenaf produced under Tunisian semi arid conditions

H. Ammar¹, M.A. Lahyeni¹, R. Lahsoumi², M. Ben Younes³ and S. Lopez⁴

¹Ecole Supérieure d’Agriculture de Mograne, 1121 Mograne (Tunisia)
²Office de l’élevage et des Pâturages de Tunis, Alain Savarey, 1002 Tunis
³Pôle de Recherché, Le Kef 7030 (Tunisia)
⁴Dprt Produccion Animal, Univeridad de Leon, 24007 Leon (Spain)
e-mail: hjr.mmr@gmail.com

Abstract. Kenaf, Hibiscus cannabinus L, is a warm-season annual fiber crop. The stem is a source of fibre production. In Tunisia, kenaf production was introduced in the humid and saharian regions since 1998. Possibility of its culture in Zaghouan, a Tunisian semi arid region, and the optimal density for a higher yielding and nutritive value was our main objective. Three seeding densities (seeds/m²) were used: 27 (D1); 13 (D2) and 5 (D3) seed/m². Harvesting was at 75 days age. The highest yield (11.6 t/ha) in terms of edible dry matter (DM) was recorded for D1 and the lowest (6 t/ha) for D3. Protein content was higher (>17%) in leaves and lower (<12%) in stems. The main handicap of its production is water resource. Agricultural companies should be carried out to well introduce this plant in the agriculture systems since it can be a good precursor for some cereal culture due to its capacity to incorporate a high organic matter amount in the soil.

Keywords. Kenaf – Nutritive value – Seeding density – Maturity stage.

I – Introduction

Kenaf (Hibiscus cannabinus L., Malvaceae) is a warm season annual fiber crop closely related to cotton (Gossypium hirsutum L., Malvaceae) and okra (Abelmoschus esculentus L., Malvaceae) that can be successfully produced in a large portion of the world, particularly in Africa. This annual specie is characterized by its 3- to 4-m height and high production of biomass which is composed primarily of cellulose-rich stalk (Webber, 1993) from which the fiber is extracted. Kenaf requires less than 6 months for attaining a size suitable for practical application. For industrial purposes, the apical part of the plant rich in protein and low in cellulose, may be considered a
by-product potentially suitable for livestock production. As the commercial use of kenaf continues to diversify from its historical role as a cordage. Based on the optimum of forage quality and quantity, kenaf was best harvested between 10 and 12 weeks after planting, when CP is approximately 15% (Phillips et al., 1999). The ground leaves of kenaf have high digestibility and can be used as a source of roughage and protein for cattle and sheep (Webber, 1993) especially when harvested early (González-Valenzuela et al., 2008). Little information is available regarding kenaf forage response to population density, which affects plant morphology, dry matter (DM) accumulation, and susceptibility to lodging. Information of potential yield and chemical composition of kenaf as fodder for ruminants in the Mediterranean areas, especially under semi-arid conditions, is presently insufficient. Therefore, the objective of this study was to assess the technical culture of kenaf under Tunisian semi-arid conditions, determine the influence of population density on kenaf dry matter (DM) and fresh matter (FM) yields, and forage quality at 75 days after sowing (DAS).

II – Material and methods

1. Kenaf growth and harvest

The kenaf was grown on land owned by the Agricultural High School of Mognane, government of Zaghouan (center east of Tunisia). The experimental field area covered 1000 m$^2$ (20x50) and divided into height plots. Plots were 2 m spaced and had a 69 m$^2$ surface (23 x 3 m). They were sown at different seed densities (seeds/m$^2$). In our present study we focused our aim on only three densities: 27 (D1); 13 (D2) and 5 (D3). The crop was sown in June 2011 and harvested at 75 days age at a height of 180 to 190 cm. The soil was loamy clayey and its pH was 8. Prior to planting, plots were ploughed and fertilizer was applied at a rate of 50 kg/ha N and 150 kg/ha P. No K was supplied, as its status was already adequate in the soil. All plots were kept weed-free by hand weeding throughout the growing season.

During growth, the plots were managed as irrigated crops receiving a daily irrigation. At 75 days after planting, kenaf was harvested by hands at approximately 5 cm above ground level using a 1x1m quadrant (three replicates for each plot). Plants within the quadrant were immediately weighed to determine fresh weight. Leaves and stems of the whole plant from each plot were manually separated and dried at 60°C to constant weight.

2. Chemical analysis and in sacco dry matter degradability

Dried samples of young stems and leaves were ground through a 1 mm screen and analyzed for the contents of crude protein (CP), ash (AOAC, 1990), neutral detergent fiber (NDF) and acid detergent fiber (ADF) (Robertson and Van Soest, 1981) and Van Soest et al. (1991). For the determination dry matter degradation, samples of leaves and young stems were ground through a 3mm sieve and two replicate samples of each, weighing about 3g, were placed into nylon bags and incubated in the rumen of fistulated heifer. Elapsed the incubation time (48 h), bags were gently rinsed with tap cold water, oven dried (60°C, 48 h) and weighed to calculate the degradability of the dry matter as the difference between the initial vegetal material (3 g) and the residual of the incubation. The fistulated heifer was fed on concentrate (4 kg/d) and alfalfa hay (8 kg/d).

III – Results and discussion

1. Vegetative growth of kenaf and biomass production

It is well reported that biomass production is influenced by vegetative and growth rate of the plant, population density. In our present study three plant densities were examined: 27 (D1), 13 (D2) and
5 (D3). At very low planting densities (<20 plants/m²) kenaf produces multiple branches, which renders harvesting more difficult (Massey, 1973). Nevertheless stem diameter decreased as population density increased resulting from intraspecific competition among plants (Acreche et al., 2005, Reta et al., 2010). This fact can explain partly the lowest DM contents (21.2 %) reported in this present study when plant density is the lowest (5 plants/m²). Similar DM contents were recorded earlier (19.1%) by Rude et al., (2002) when kenaf was harvested at 42 DAS. In relation with plant density, an opposite trend was observed for fresh and dry matter yields of the whole plant (Table 1). The highest yields of fresh (51.9 t/ha) and dry matter (11.6 t/ha) corresponded to the highest density (27 plants/m²). These DM production yields were dramatically higher than that reported by Chantiratikul et al., (2009) who recorded 0.12-0.95 t/ha DM yield harvested 75 DAS. It appears therefore that DM yield of kenaf do depend upon plant variety, seeding rate, maturity stage (Bañuelos et al., 2002) and other agronomic factors.

Table 1. Dry matter (DM) contents (%) and biomass production (Fresh matter, FM; and dry matter, DM) (t/ha) of kenaf at different seeding densities

<table>
<thead>
<tr>
<th>Plant density</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
</tr>
</thead>
<tbody>
<tr>
<td>% DM</td>
<td>22.3</td>
<td>22.7</td>
<td>21.2</td>
</tr>
<tr>
<td>FM (t/ha)</td>
<td>51.9</td>
<td>39.9</td>
<td>29.2</td>
</tr>
<tr>
<td>DM (t/ha)</td>
<td>11.6</td>
<td>9</td>
<td>6.2</td>
</tr>
</tbody>
</table>

2. Chemical composition and in sacco DM degradability

Data on chemical composition and in sacco DM degradability of leaves and stems of kenaf harvested at 75 DAS are presented in Table 2. Mineral contents varied between 6.7 and 12.6% corresponding the lowest values to stems (D1) and the highest to leaves (D3). Kenaf leaves contain a higher concentration of CP (>22%) and in sacco DM degradability (>70 DM) than the stems (Table 2) which are less digestible (36-40% DM) due to their high NDF(54-65%) and ADF (42-50%) contents and poor levels of CP (7.5-11.5%). This was expected because mature tissues (at the base) accumulate higher amounts of metabolic products than the younger parts at the top. With respect to plant density, increases in population density were not related to kenaf nutritive value in terms of crude protein (CP) and fiber concentrations as was suggested earlier by Reta et al. (2010). This response is probably predictable when considering that density increase did not modify the forage leaf and stem proportions, which are related to forage quality in terms of CP and fiber concentrations (Swingle et al., 1978). The average CP, NDF and ADF concentrations were slightly higher than those reported either by Reta et al. (2010) who recorded 177, 453, and 524 g/kg respectively for the whole plant harvest at 87 DAS or by Muir (2002) with a population density of 16 plants/m² and harvested at 83 DAS during its flowering phase. When compared with leaves, this author reported lower CP concentrations (192 g/kg) and higher ADF (280 to 290 g/kg) and NDF (350 to 380 g/kg) concentrations. The higher CP and lower NDF and ADF concentrations reported in our study, as compared with those of the other authors can be probably due to an earlier phonological phase at harvesting.

To optimize forage quality and quantity, kenaf should be harvested between 60 and 80 days after planting since the proportion of leaf in the total DM decreases dramatically at about 80 days after planting (Phillips et al., 1999). Crude protein content at this time would be >15% and in situ OM disappearance could be >69% (Phillips et al., 1999). These findings justify partly the successful use of kenaf to replace Alfalfa as a crude protein supplement for lambs fed Bermuda grass or Fescue hay.
IV – Conclusion

This research further supports the feasibility of producing kenaf not only for fiber, but also for a livestock feed. The greater water requirement of kenaf could be a problem in areas where irrigated water is limited. An optimum population density for DM production corresponded to 27 plants/m². However, for an optimum nutritive value in terms of CP and DM degradability a density of 13 plants/m² was accepted. Future research should focus on cultural methods to maximize kenaf’s nutritive value and total dry-matter production.

References


