

In-Vitro and *In-Situ* Evaluation of Guar Hay
(*Cyanopsis Tetragonoloba*) as a Roughage
Source for Ruminants

H.M. Ali, *H.S. Soliman, M.M. Shoukry, M.M.**. IE-
Trabolsy and N. Eid

* National Research Center, Egypt Fac. Agric.
Ain-shams Univ.,

** and High Institute for Agriculture Co-operation

CHEMICAL composition along with *In Vitro* and *In-Situ* dry matter disappearance of solar dehydrated Guar (*Cyanopsis tetragonoloba*) hay was compared with that of berseem (*Trifolium alexandrinum*) hay.

Guar hay contained higher values for crude fibre CF. (29.9 vs 22.3) ether extract EE. (3.6vs 1.3) and lower values for crude protein CP (14.9vs 17.6) neutral detergent fibre NDF. (40.8 vs 57.9) acid detergent fibre ADF (28.0vs 35.7) and acid detergent lignine ADL (11.7vs 17.8) than berseem hay.

In-Vitro dry matter digestability (IVDMD) was higher for berseem hay than guar hay (62.3vs 55.4). Also dry matter digestibility (DMD) of berseem hay was higher than those of guar hay. The results are discussed in relation to cell contents and cell wall constituents of guar and berseem hay.

It was concluded that guar hay can successfully be used in rations for ruminants in newly reclaimed areas.

At the present time, public debate is centered around increasing agriculture out-put to face the massive population increase in Egypt.

In summary, it has been concluded that this can be achieved either vertically by improving the Land and resources already available, or horizontally by increasing the area of cultivated land.

Although facing many problems, the later practice appears very promising with the introduction of advanced technology concerning water use and management. Among these problems is the shortage of water and possibly the high salinity of both water and soil. Thus the choice of plants to be grown in such areas is very difficult, because they have to be tolerant to both Salinity and drought, and above all of good nutritional value for both humans and animals.

Gur (*Cyanopsis tetragonoloba*) is a leguminous plant that can successfully be grown in such areas (El-Noubi, 1962 and Anonymous, 1975). It's seeds is a potential source of protein for live-stock, after extracting the gum which is an important product in food, cosmetic and pharmaceutical industries (Anonymous 1975).

Guar hay appears also to be a promising roughage source for ruminants. The present work is carried out to examine the chemical composition, In-Vitro and In-Situe evaluation of the nutritive value of guar hay as compared with a standard good quality roughage such as berseem hay (*Trifolium alexandrinum*).

Material and Methods

Guar was cultivated in the farm (1 Feddan) of the medical and pharmaceutical lab. of the National Research Centre (NRC), Dokki, Cairo, from November till March 1980. Nitrogen (N) fertilization was applied at the rate of 16N units / feddan.

A sample of fresh guar plants (before flowering and about 70cm height) was collected from the farm, transported to the animal and poultry nutrition lab. of the NRC. The plants were then washed, dissected into their aereal parts (stems and Leaves), stem and Leaves then installed to be dried in a solar energy drier at the NRC for 26 hr. Finely ground sample of each part was chemically analysed for dry matter (DM), ash, Nitrogen (N), ether extract (E E), crude fiber (CF) and Nitrogen free extractives (NFE) according to the A.O.A.C. (1965). Neutral detergent fiber (NDF), acid detergent fiber, (ADF) and acid detergent Lignin (ADL) were determined for the aereal parts only according to Van Soest (1967).

In-Vitro dry matter disappearance (IVDMD) was determined for guar hay prepared from aereal parts, stems and Leaves according to the method of Tilley and Terry (1963). Fermentation media used was that described by Norris *et al.* (1976) with a modification that the buffer and the urea solutions were those described by Naga and El-Shazly (1963).

Degradability of DM of guar hay (aereal parts) in the rumen of sheep was determined at 4, 8, 12, 24 and 48 hr using dacron bags (Mehrez and Orskov, 1977).

A sample of second cut, sun-dried berseem hay (aereal parts) was used as a standard good quality roughage source for the purpose of comparison. Gross chemical composition including NDF, ADF and ADL along with IVDMD and DM degradability were determined for this sample as mentioned above.

Animals and their management

Three mature male Ossimi sheep (about 50 kg live weight) fitted with rumen cannula were used in this study, for determinations of DM degradability of both guar and berseem hay. The animals were maintained on a ration consisted of berseem hay given at the rate of 150% maintenance in two equal meals mainly at 8:00 a.m and 16:00 p.m. water was always available in front of the animals.

About 3g of dried, finely ground (less than 1/2cm length) guar or berseem hay was weighed in each dacron bag. The required number of bags (3/each incubation period) for guar or berseem hay was incubated in the rumen of

each sheep and one bag was withdrawn from the rumen of each sheep at each incubation period (4, 8, 12, 24 and 48 hr). The bags were washed under running tap water until water become clear from any colour. They were then dried in an oven at 60° for 48 hr or to a constant weight and Dm disappearance was calculated.

Results and Discussion

Morphological description of guar plants

The fresh whole guar plant (airal parts+roots) weighed 95g on average, while the airal parts weighed 87.5g and the root weighed 7.5f i.e. airal parts contributed 92% of the weight of the fresh plant. Leaves weighed 38.8g and the stem 48.8g, representing 44.3 and 56.0% of the weight of the airal parts.

Chemical composition

Chemical composition of guar hay prepared from airal parts, stem or leaves along with that of second cut berseem hay is presented in Table 1. As expected guar leaves had the highest value for CP, NFE and ash and the lowest value for CF compared with airal parts or stems. The high ash content recorded for guar leaves may have been due to soil contamination.

TABLE 1. Chemical Composition and IVDMD of Guar and Berseem hay 2-nd cut.

	Composition, % DM basis								IVDMD %
	CP	CF	EE	Ash	NFE	NDF	ADF	ADL	
Guar hay	14.95	29.96	3.60	11.09	40.40	40.78	28.00	11.72	55.43
Cuar Stems	12.3	39.97	2.56	7.65	37.52	—	—	—	35.21
Cuar Leaves	19.39	10.03	4.22	20.81	45.55	—	—	—	66.65
Berseem hay	17.60	22.29	4.22	14.30	41.81	57.95	35.67	17.83	62.29

Compared with berseem hay, guar, hay prepared from airal parts contained less CP (17.6 vs 14.9%) and ash (14.3 vs 11.190). Guar hay however contained more CF (30.0 vs 22.3%) and EE (3.6 vs 1.3%) than berseem hay. Similar results have been reported by El-Noubi (1962) for both CP and EE/ of guar. He obtained however higher value for CF than that recorded in this study (49 vs 30%). This was possibly because the plants used in his study were more mature than those used in the present study.

Fractionation of the cell wall constituents of guar and berseem hays, showed that guar hay contained lower values for NDF (40.8 vs 59.9%) ADF (28.0% vs 35.7) and ADL (11.7% vs 17.8), than berseem hay (Table). *In Vitro* dry matter disappearance was higher, however, for berseem than guar hay (62.3 vs 55.4%). This may have been related to the higher CF content of guar than berseem hay (Van Soest, 1967 and Horn *et al.* 1979). Moreover, although guar contained lower percentage of ADL than berseem hay yet its ADL content was higher than berseem hay when its CF content was taken into consideration. The possibility that Lignin-Carbohydrate complexes of guar hay were more resistant to rumen fermentation than that of berseem hay cannot be ruled out (see Van Soest, 1967).

The results obtained for DM degradability (Table 2) for both guar and berseem hays agreed well with those recorded for IVDMD. Degradability of DM was nearly similar for guar and berseem only after 8hr of incubation. This may be related to the nearly similar NFE content of both hays. It is well known that the cell contents is completely degradable in the rumen (Hungate, 1966 and Van Soest, 1967). Dry matter degradability of berseem hay was however, higher than that of guar hay from 8hr up to 48hr. This was probably related to differences in their CF and ADL content as mentioned earlier. The present results, were in contrast with those reported by El-Noubi (1962), who found that guar hay was more digestible than berseem hay.

TABLE 2. *In situ* DM disappearance (%) of Guar and Berseem hay at different times of incubation.

	Incubation period, hr				
	4	8	12	24	48
Guar hay . . .	40.58	54.34	56.07	69.18	75.13
Berseem hay . .	40.50	51.20	61.23	73.21	82.45

In his experiments, sheep given berseem hay consumed their diets eagerly while those given guar showed some difficulties in consuming their diets and were more selective towards the tender parts of the plants. Differences in food intakes may have been responsible for the discrepancy, observed between the present results and those of El-Noubi (1962). Although slightly less digestible than berseem hay, the present results and those of El-Noubi (1962) tend to suggest that guar hay is a promising roughage source that can successfully be used in rations for ruminants. Work in progress to explore the extent to which guar hay can be used in place of berseem hay in rations for growing lambs.

References

- Anonymous (1975) In Underexploited Tropical plants with promising economic value. National Academy of Sciences Washington, D.C.
- A.O.A.C. (1965) "Official Methods of Analysis", 10th ed. Official Agriculture Chemistry Washington, D.C.
- El-Noubi, H.M. (1962) Nutritive value of guar (*Cyamopsis tetragonoloba*) as a green fodder for sheep. In proc 1st Animal Nutrition conference (P 105 held in the high agriculture Institute, MENIA, EGYPT.
- Horn, F.P., Telford, J.P. Mc Croskey, J.E., Stephens, D.F., Whiteman, J.V. and Totusek, R. (1979) Relationship of animal performance and dry matter intake to chemical constituents of grazed forage. *J. Anim. Sci.* 49, 1051.
- Youngate, R.E. (1966) "The Rumen and its Microbes". Academic press New York and London.
- Mehrez, A.Z. and Orskov, E.R. (1977) A study of the artificial fiber bag technique for determining the digestibility of feeds in the rumen. *J. Agric. Sci. Camb.* 88, 645.
- Naga, M.M.A. and El-Shazly, K. (1963) The use of In-Vitro fermentation technique to estimate the digestible energy content of some Egyptian forages, 1. The In-vitro digestion of cellulose as criterion of energy content. *J. Agric. Sci. Camb.* 61, 73
- Norris, K.H., Barnes, R.F. Moore, J.E. and Shenk, J.S. (1976) Predicting forage quality by reflectance Spectroscopy. *J. Anim. Sci.* 43, 889.
- Tilley, J.M.A. and Terry, R.A. (1963) A two stage technique for In-Vitro digestion on forage feeds. *J. Brit. Grassland Soc.* 18, 104.
- Van Soest, P.J. (1967) Development of a comprehensive system of feed analysis and its application to forages. *J. Anim. Sci.* 26, 119.

التقييم الفئائي لنبات الجوار كهادة خشبنة في أعلاف المجترات •

حاتم محمد علي ، حسين سعد سليمان ، محسن محمود شكوي ، ماجد
الطرابلسي ، محمد نبيل عيد

المركز القومي للبحوث ، كلية الزراعة - جامعة عين شمس والمعهد العالي
للتعاون الزراعي •

استخدم في هذه التجربة دريس محضر من نبات الجوار المتسرع يموزعة
النباتات الطبية والعطرية بالمركز القومي للبحوث وذلك لتقدير التركيب
الكيمائي وكذلك دراسة معدل اختفاء المادة الجافة معمليا ومقارنتها
بالدريس الناتج من البرسيم والمحضر بنفس الطريقة (تجفيف شمس
باستخدام مجفف يعمل بالطاقة الشمسية) •

وتشير النتائج الى أن دريس الجوار يحتوى على نسبة من الالياف الخام
والدهن الخام أعلى من تلك الموجودة بدريس البرسيم (٢٩.٩٩ مقابل
٢٢.٣٣ و ٣.٦٣ مقابل ١.٣٣) كما أن نسبة البروتين الخام بدريس الجوار
كانت أقل من مثيلتها في دريس البرسيم (١٤.٩٩ مقابل ١٧.٧٦ %) •

وقد أظهر تحليل فان سوست أن الـ ADL, ADF, NDF
كانت أقل في دريس الجوار عن مثيلاتها في دريس البرسيم (٤٠.٨٨ مقابل
٥٧.٩٩ ، ٢٨.٠٠ مقابل ٣٥.٧٧ ، ١١.٧٧ مقابل ١٧.٧٨ على التوالي) •

أما معدل اختفاء المادة الجافة لدريس الجوار فقد كان أقل من دريس
البرسيم وكذلك كان معدل هضم المادة الجافة أقل في دريس الجوار
عن دريس البرسيم •

وبصفة عامة فان النتائج تقترح امكانية استخدام نبات الجوار
بنجاح في تغذية المجترات •