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INFLUENCE OF *Acacia saligna*, *Morus nigra*, *Salix tetraspema* AND *Tipuana tipu* ON DIGESTION, IN SITU DM AND CP DISAPPEARANCE AND MILK PRODUCTION IN SHEEP.

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ABSTRACT

Leaves from the shrups *Acacia Saliga, Morus nigra, Salix tetraspema* and *Tipuana tipu* irrigate by wastewater of New Borg El-Arab City were evaluated as a sole feed or supplemented with concentrate feed mixture (250g) for sheep. The tested plants were nutritionally evaluated in two parallel experiments. The first experiment (3 x 3 Latin square) was carried out on Suffolk x Barki rams to determine nutrients digestibility and utilization of dietary nutrients for the tested plants. Rumen fermentation patterns for the tested plants were estimated on three fistulated ewes using the Nylon technique. In the second experiment, a feeding trial (4 x 5 factorial) for 120 days was applied on 20 pregnant (3 months) Barki ewes, where they randomly according to their previous average daily milk production in four equal groups. Plants were offered ad lib, while concentrate feed mixture (CFM) was offered (250 g/h/d) in two equal portions (7.00 am and 16.00 pm). Daily milk yield was individually recorded and milk composition was biweekly determined. Heavy metals (Zn, Pb, Cd, Cu and Cr) in tested plants, feces, urine, milk and serum blood in addition to hemato – biochemical constituents were determined. Measured nutritional parameters for experimental plants on sheep indicated that, both rate of either DM or CP degradation and their effective degradability values were increased with *Morus* leaves than other plants. Nutrient digestion coefficients of OM, CP, CF, NDF, ADF and EE were improved ($P<0.05$) with *Morus* leaves. Dietary nitrogen utilization was obviously higher ($P<0.05$) with dietary feeding *Morus* leaves. Ruminal pH values were higher for *Acacia* at all sampling times than other tested plants. Whereas, NH_3 – N concentration was lower ($P<0.05$). , while corresponding values were comparable for other tested plants. Ruminal VFA's and acetate concentration were higher for *Morus* leaves, while more butyrate was recorded for *Tipuana* leaves. Results of the feeding experiment on lactating ewes illustrated that, daily milk production and milk fat and protein content were increased ($P<0.05$) with feeding *Morus* leaves and CFM in comparison with other tested plants. *Acacia* showed higher ($P<0.05$) milk content of Zn, Pb, Cu and Cr, while higher milk content of Cd was noticed with *Tipuana*. *Salix* was the less milk content of all measured heavy metals. No significant differences were observed among sheep for their blood constitutions of TP, A, G, A/G ratio, Pb and Cd.

It could be concluded that, *Morus* or *Salix* as leguminous trees and shrubs can be used as a sole fodder feed for sheep, especially of those of the new reclaimed lands irrigated by wastewater in order to fill the gab of shortage of some green forages and to improve animals productivity in the North Coast of Egypt. However, in the case of *Acacia*, it should be supplemented with any energy source.

Keywords: Sheep, Shrubs, digestibility, In situ degradability, Lactation, intake.

INTRODUCTION

Large tracts of arid and semi-arid lands in the northwestern coast of Egypt are not cultivated but are used to raise livestock, mainly sheep, goats and camels. However, because of low annual rainfall and consequently, low feed availability, the raisin of livestock in these areas is tenuous. In contrast to herbaceous vegetation, many trees and shrubs remain green all year, even during drought. Consequently, it has been suggested that they could be useful as fodder for livestock in arid and semi-arid areas (El-Shaer *et al.*, 1984; Seligman *et al.*, 1989; Lefroy *et al.*, 1992; Maharem and Eman Ismail, 2002). Leguminous trees, in particular, have been examined as potential sources of fodder (Topps, 1992) as they maintain a relatively high crude protein content throughout the year.

Most of such trees and shrubs are highly drought resistant and salt tolerant; with its massive perennial growth can provides enough palatable green reserve, which can be of substantial value for feeding animals during dry summer and autumn seasons, when there is a shortage of available feed on the range.

Abdel Basit and Fatma Hassan (2000) and Hafez and Fatma Hassan (2001) investigated *Acacia* , *Morus*, *Salix* and *Tipuana* as supplementary forages to barley in feeding of growing sheep.

The studies reported below investigate the comparative value of these plants as a sole feed or supplemented with concentrate feed mixture. Their degradability in the rumen long sides the effect on milk production and biochemical blood straits in sheep.

MATERIALS AND METHODS

Collection and chemical analysis of forages

Leaves from *Acacia* Saligna, *Morus* nigra, *Salix* tetraspema and *Tipuana* tipu were collected from the experimental field located at New Borg El-Arab City, North Coast of Egypt. The soil and cultivation were described by Abdel Basit and Fatma Hassan, (2000) and Hafez and Fatma Hassan, (2001). Branches of each shrub were removed manually and placed in a shed. Leaves were allowed to air dry on the branches and then removed carefully. Each plant forage was analyzed to determine dry matter (DM), ash and crude protein (CP) content by AOAC (1990) procedures. Natural detergent fiber (NDF) and acid detergent fiber (ADF) were determined by methods of Goering and Van Soest (1970). Acid detergent Lignin (ADL) was also measured (AOAC, 1990). Condensed tannins expressed as cathechin equivalents (CE) was measured using vanillin- HCl procedure of Burns (1971) as modified by Price *et al.* (1978)

***In vivo* digestibility**

In this experiment, the four tested plants (as fed) were used as a sole feed. Three adult male sheep (Saffolk x Barki) weighting approximately 52.5 kg BW were housed in metabolism cages and assigned to the four plants (three sheep/ treatment). Plants were offered ad lib in two equal portions daily (0800 and 1600). Drinking water was available at all times. The classical metabolism trials wee carried out as described by Maynard *et al.* (1979). Each trial lasted 22 days, preliminary and collection periods lasted 15 and 7 days, respectively. Chemical composition of feeds, feces and urinary nitrogen was determined according to AOAC (1990).

In Situ degradability

In this experiment the rate and extent of DM and N disappearance from nylon bags for each of the four experimental plant species were evaluated using other three femals ruminally cannulated sheep (average BW of 52.0 kg and age 4 years) in a 3x4 Latin square experiment using artificial fiber bag technique (Orskov and McDonald, 1979). During the experiment, all sheep received berseem hay ad libitum. Bags (6 cm x 12 cm and 53 µm pore size) containing 5 g of ground samples of each plant were incubated in the ventral part of the rumen and were removed after 3,6,12,24,48, 72 and 96 h in two sequence periods. After removal from the rumen, bags were washed in cold water with gentle squeezing until the water became clear. Zero time disappearance values were obtained by washing unincubated bags in the similar fashion (Ash, 1990). Bags were dried in an oven at 60 °C for 48 h and DM loss were recorded and samples were removed from each bag for total N analysis. In situ degradation data for DM and CP were fitted to the equation of Orskov and McDonald (1979): $p = a + b\,(1-e^{-ct})$, where p = degradation rate at time t, a= an intercept representing the portion of DM or CP solubleized at initiation of incubation (time 0), b= the portion of DM or CP potentially degraded in the rumen, c = rate constant of degradability of DM (EDDM) and CP (EDCP) was calculated using the following equation:

$ED = (a + b)\ c/\ (c + k)\ (e^{-(ct)\,T})$ where k is the estimated rate of outflow from the rumen, T = log time (h), and a,b and c are the parameters described previously. The EDDM or EDCP were estimated for each forage assuming ruminal particulate outflow rate 3% h which should be representative of medium feeding amounts (ARC, 1984).

Rumen measurements

Ruminal liquid samples were taken in two sequence days for each tested plants (as a sole feed) at 0, 3 and 6h postfeeding using three rams fitted with rumen cannula. Ruminal samples were analyzed immediately for pH using pH-meter (Model 201- Orion Research digital) , samples were strained through four layers of cheesecloth. For each sampling time, rumen fluid samples were preserved for ammonia nitrogen (NH_3-N) determination by the Conway (1962) method and VFA concentrations and molar proportions were determined by gas chromatography (Jouany, 1982).

Lactation study

In this experiment, twenty ewes (Saffolk x Barki) weighing approximately 47.50 kg ± 2.0 kg (at 2-3 years of age) were stratified for initial body weight BW and age for one of tested feeds. Each group composed of 5 pregnant animals at three months. All animals were housed in semi-open pens in which water was available *ad-libitum.* Animals fed 250 g of concentrate feed mixture (CFM) (14.21 % CP) plus one of the tested feeds (leaves) ad libitum for 120 d (60 days before and 60 days postpartum). The tested feeds and concentrate were offered in two equal portions daily (8.00 and 16.00). For milk measurements, kids were kept with their dams all the time except on the day of milk yield determination day. The kids separated from heir dams at 19:00 the day before. Ewes were milked at 07:00 and 17:00, milk samples were collected once biweekly at 0 (Colostrum), 2, 4, and 8 week for estimation of milk production by Galatov (1994). Milk samples were chemically analyzed for total solid (TS), protein, fat and ash contents according to AOAC (1990), while lactose was calculated by differences.

Heavy metals and blood analysis

Heavy metals (Zn, Pb, Cd, Cu an Cr) in tested plants, feces, urine, milk and serum blood were extracted according to Fick *et al.* (1979) and determined by using Shimadzu Atomic Absorption Spectrophotometer (Model AA 640-13).

Blood samples were collected three times (before, the mid and at the end of experiment) from the external jugular vein of animals, at the morning before access to feed and water. Serum was separated and stored at – 20 °C until used for analysis. Whole blood was tested just after collection for hemoglobin (Hb) by the cyanomethemoglobin method (Wintrob, 1965). Serum total protein (TP) and albumin (A) were measured by using bio-Merious kids. Serum globulin (G) was obtained by subtracted A from TP. Kidney function evaluated by measuring blood urea using the calorimetric methods according to Henery and Todd, (1974) by using kids. Creatinine was measured using calorimetric method according to Faulkner and King (1976).

Measuring the activity of aspartate amino-transferrase (AST) and alanine aminotransferase (ALT), they were assayed in the serum by the method of Reitman and Frankel (1957) assessed liver function.

Statistical analysis

Data were analyzed by one-way using the GLM procedure of SAS (1988). Means were separated by the LSD method ($p<0.05$; Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Chemical composition

The chemical composition of the experimental feeds is presented in Table 1. The *Morus* leaves had a typical composition (Roothaer and Paterson, 1997; Yao *et el.*, 2000; Liu *et al.*, 2001), and comparable with those of leguminous forages and trees (Smith, 1994; FAO, 1988). However, its CP content was higher than leaves of other experimental feeds. *Tipuana* leaves had the second higher CP content, its similar to that reported by Norton and Waterfall (2000). Less CP content was showed by *Acacia* leaves (13.12%). The fiber content was similar for *Acacia* and *Salix* leaves (24.32 and 24.37%, respectively), but *Morus* had the lowest content 9.67 %, while *Tipuana* had intermediate content (19.61%). Mours leaves showed highest EE content (14.35%) and ash content (13.59%) compared to other leaves in this study. However, all leaves showed quite similar NDF and ADF with the exception of *Tipuana* had less NDF (34.86%) and *Morus* had less ADF (23.26%). Both *Morus* and *Tipuana* leaves had lowest ADL content (6.81 and 8.4%, respectively), followed by *Acacia* (12.68 %), while *Salix* had higher content (18.15%). *Acacia* , leaves had noticeable more condensed Tannins (12.78%) than other leaves in this study, while *Morus* leaves was the less content (4.68%). However, the chemical composition of the experimental feeds had comparable with those of leguminous shrubs and trees (Sharon and Barry, 1988; Smith, 1994; Ramirez and Lara, 1998; FAO, 1998; Norton and Waterfall, 2000; Nantoume *et al.*, 2001).

Table (1) : Chemical composition of experimental feeds.

Item	*Acacia*	*Morus*	*Salix*	*Tipuana*
DM	37.88	27.06	38.47	31.46
		On DM basis (%)		
OM	92.13	86.41	92.94	89.82
CP	13.12	20.63	16.41	18.48
CF	24.32	9.67	24.37	19.61
EE	2.69	14.35	2.07	2.11
NDF	45.17	43.70	41.65	34.86
ADF	30.63	23.26	33.17	30.20
ADL	12.68	6.81	18.15	8.4
Ash	7.87	13.59	7.06	10.18
Cond. Tannin *	12.78	4.68	6.40	6.71

Condense Tannin

In vivo digestibility

Feed intake and in vivo digestibility are given in Table 2. Apparent OM, CP, CF, NDF and EE digestibility were higher (P<0.05) for sheep fed *Morus* leaves than other experimental leaves. Sheep fed *Salix* leaves had shown higher (P<0.05) apparent DM digestibility and similar ADF digestibility to that of sheep fed *Morus* leaves. Lower (P<0.05) apparent DM, OM and CP digestibility were noticed with sheep fed *Acacia* leaves. These could due to its high level of tannins, which form insoluble protein and carbohydrate complexes; N, NDF and ADF digestibility are most likely to be affected by high concentrations of tannins in the diet (Nantoume *et al.*, 2001). However, Holechek *et al.*(1990) found that diet containing browse species high in phenolic/ tannin compounds, resulted in decreased intake by goats and sheep, compared with species with low levels of these substances. They concluded that high phenolic shrubs adversely influenced the nutritional status of Angora goats through decreased in forage intake and digestibility. Bhattacharya (1989) reported same finding for Najdi sheep and Rafique *et al.* (1992) with sheep as well. Moreover, Reed *et al.* (1990) reported that sheep fed forage from *Acacia* s had decreased fiber digestion as a result of the high level of condensed tannins in *Acacia* s. On the other hand, high level of ash content might lead to a reduction in the metabolism energy of these forages

(Benavides and Pezo, 1986). Results from this study confirmed the finding from literature regarding the intake and digestibility of browse species. Whereas, *Acacia* had the lowest DMI, CP and fiber digestibility, while *Morus* as it had lower condensed tannins (CT), showed more digestibilities than *Salix* and *Tipuana* leaves. Even though they have quiet less CT. Therefore, the lower nutritive value of *Acacia* compared to other native shrubs used in this study can probably be explained by its high concentration of condensed tannin and lignin. It is well known that increasing condensed tannin markedly depress rumen digestion of structural carbohydrate, apparent digestibility and voluntary intake (Barry et al., 1986; Waghorn *et al.,* 1987).

Table (2): Voluntary dry matter (DM) intake, digestibilities of nutrients and nutritive values of experimental feeds fed to sheep.

	Experimental plants			
Item	***Acacia***	***Morus***	***Salix***	***Tipuana***
	DM Intake, g/h/d, %			
	463.49±12.14^{c}	701.95±20.33^{b}	928.54±43.20^{a}	502.90± 31.27^{c}
	Nutrients digestibility (%)			
DM	47.63 ± 0.47^{d}	59.19 ± 0.51^{b}	61.40 ± 0.71^{a}	52.59 ± 1.47^{c}
OM	49.99 ± 1.39^{d}	64.31 ± 0.19^{a}	62.29 ± 0.55^{b}	55.63 ± 1.15^{c}
CP	34.37 +1.73^{d}	74.63 ± 0.52^{a}	61.20 ± 1.15^{b}	55.44 ± 1.36^{c}
CF	60.88 ± 1.81^{b}	67.29 ± 1.19^{a}	61.66 ± 0.41^{b}	54.90 ± 0.85^{c}
NDF	41.70 + 0.23^{b}	47.13 ± 0.23^{a}	43.14 ± 1.14^{b}	38.50 ± 1.39^{c}
ADF	31.50 + 1.03^{b}	40.31 ± 1.24^{a}	39.26 ± 1.87^{a}	33.62 ± 1.11^{b}
EE	46.04 ± 1.40^{b}	69.57 ± 1.19^{a}	31.91 ± 1.20^{c}	18.17 ± 1.96^{d}
NFE	78.79 ± 1.58^{a}	57.47 ± 1.22^{c}	64.48 ± 0.36^{b}	56.21 ± 1.36^{c}
	Nutritive value, %(DM basis)			
TDN	47.76 ± 1.14^{d}	67.69 ± 0.28^{a}	58.54 ± 0.59^{b}	53.14 ± 0.97^{c}
DCP	4.51 ± 0.23^{c}	15.40 ± 0.11^{a}	10.04 ± 0.35^{b}	10.24 ± 0.25^{b}

a.b,c and d = Means on the same line with unlike superscripts differ (P< 0.05).

Table (3): Nitrogen utilization (g/d^{-1}) for sheep fed the experimental feeds.

Item	*Acacia*	*Morus*	*Salix*	*Tipuana*
N balance, g/d				
N – Intake	9.73 ± 0.40^{d}	23.17 ± 2.13^{a}	24.38 ± 0.73^{b}	14.87 ± 2.75^{c}
Fecal – N	6.40 ± 0.86^{b}	4.48 ± 1.01^{c}	9.47 ± 1.02^{a}	6.62 ± 0.98^{b}
Urinary – N	5.99 ±1.21^{b}	12.72 ± 0.81^{a}	11.95 ± 0.02^{a}	5.06 ± 1.04^{b}
Retained – N	0.41 ± 0.17^{d}	5.97 ± 0.53^{a}	2.96 ± 0.09^{b}	1.56 ± 0.19^{c}
% of N intake	4.21 ± 1.58^{c}	25.76 ± 2.68^{a}	12.14 ± 0.70^{b}	10.49 ± 2.35^{b}
% of absorbed N	12.31 ± 1.64^{c}	31.94 ± 3.36^{a}	19.85 ± 1.16^{b}	18.90 ± 1.17^{b}

a.b,c and d = Means on the same line with unlike superscripts differ (P< 0.05).

Sheep fed *Acacia* and *Tipuana* tended to excrete lower (P<0.05) amount of N in urine and to retain less N (0.41 and 1.56 g/d^{-1}, respectively) compared with those fed *Salix* (2.96 g/d^{-1}) and *Morus* (5.97 g/d^{-1}) (Table 3). Even though the N intake (g/d^{-1}) of sheep did not differ between *Morus* and *Salix* feeds, those fed Mours had higher (P<0.05) retained N as % of N intake than those fed *Salix* (25.76 vs. 12.14%). These could probably explained by its more N degradability than of N in *Salix* leaves.

Ruminal fermentation

Durinal variation of ruminal parameters is reported in Table 4 and Fig1. *Acacia* and *Tipuana* had higher effect on average rumen pH. Overall, NH_3-N in the rumen fluid peaked 3h postfeeding and then decreased. A depressive effect on NH_3-N concentration was observed in sheep fed *Acacia*. The minimum postprandial NH_3-N concentrations were observed in sheep fed *Acacia* as well. However, rumen ammonia concentrations in all the treatments were higher than the threshold (5 mg 100 ml^{-1}) for maximal microbial growth proposed by Satter and Slyter (1974). The lower ammonia nitrogen observed in sheep fed *Acacia* may be described to decrease of nitrogen degradation in the rumen, but could also be an effect of the average the decrease the soluble nitrogen in *Acacia* as well as it has lower CP content than all other tested leaves.

Table (4): Effect of feeding *Acacia*, *Mours*, *Salix* and *Tipuana* on mean pH, ammonia nitrogen (NH_3-N) and volatile fatty acid concentrations in the rumen fluid of sheep.

Item	*Acacia*	*Morus*	*Salix*	*Tipuana*
pH	6.50±0.04^{a}	6.35±0.03^{b}	6.37±0.03^{b}	6.44±0.06^{a}
NH_3-N(mg/100 ml $^{-1}$)	8.38± 0.08^{b}	11.61±0.17^{a}	10.87±0.10^{a}	10.19±0.05^{a}
Total VFA (mmol / 1^{-1})	61.10±0.8^{d}	92.90±1.60^{a}	80.10±0.98^{b}	75.00±1.20^{c}
Acetate(mmol /1^{-1})	67.10±3.2^{b}	75.81±1.32^{a}	70.30±1.01^{b}	68.70±0.83^{bc}
Propionate(mmol /1^{-1})	18.22±1.3^{a}	16.01±0.91^{b}	18.02±0.82^{a}	15.30±0.19^{b}
Bytrate (mmol /1^{-1})	6.38±0.22^{b}	5.36±0.91^{b}	6.24±0.01^{b}	6.60±0.03^{a}

a.b,c and d = Means on the same line with unlike superscripts differ ($P < 0.05$).

The less NH_3-N concentration noted when *Acacia* was fed could be suggested that *Acacia* protein was not being broken down rapidly in the rumen (Goodchild and McMeniman, 1994). It was possible that, in this study, *Acacia* tannins also inhabited ammonia formation as Waghorn et al. (1987) reported that protein bound to tannins is less susceptible to deamination and proteolysis. Mean VFA concentration in ruminal fluid was higher ($P<0.05$) on *Morus* treatment than on all other treatments. However, the highest VFA concentration indicates increased bacterial activity and degradation, which could have caused a higher utilization of the available soluble nitrogen in the rumen fluid. Higher ($P<0.05$) concentration of acetate was noted in rumen fluid of sheep fed *Morus* leaves, while those fed *Acacia* and *Salix* leaves tended to have higher ($P<0.05$) rumen concentration of propionate than other one. There were no differences for butyrate concentrations among treatments.

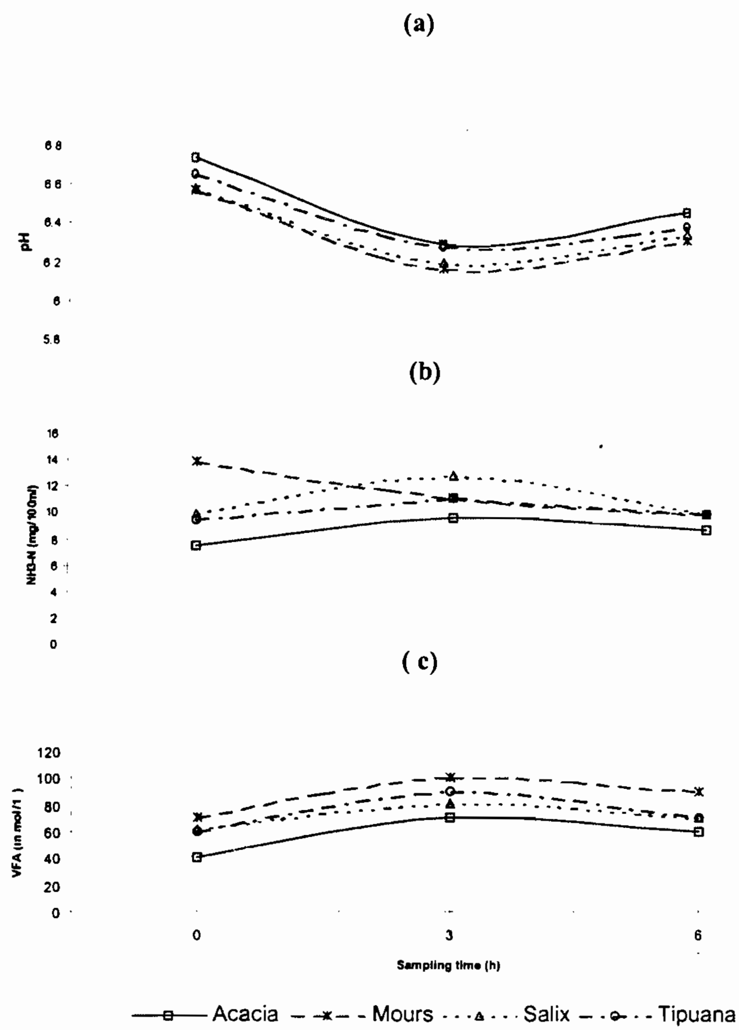

Fig (1): Daily change in pH (a) concentration of NH_3-N (b) and volatile fatty acids (VFA) (c) in the rumen of sheep fed the experimental feeds.

***In situ* degradability**

The rates of DM and CP disappearance in the rumen of sheep were higher for *Morus* leaves than for other plants. The rumen degradabilities (ED) of DM and CP were 91.13 and 95.25% for *Morus* leaves followed by that of *Salix* leaves (83.25 and 89.35%, respectively) (Table 5).

Table (5): Constant of dry matter and crude protein degradability of the *Acacia* , *Morus*, *Salix* and *Tipuana* in the rumen of sheep.

The time[e] / Plant	Degradability constant a(%)	b (%)	c(%)	Effective ED with passage rate at a+b (%)	3 % / h	SE
			Dry matter of:			
Acacia	25.70[d]	26.20[d]	0.012[cd]	51.90[d]	32.95[d]	0.23
Morus	28.03[b]	53.10[a]	0.032[a]	91.13[a]	65.23[a]	0.13
Salix	41.35[a]	41.90[b]	0.025[b]	83.25[b]	60.38[b]	0.25
Tipuana	27.25[c]	38.50[c]	0.017[c]	65.75[c]	41.15[c]	0.10
			Crude protein of:			
Acacia	24.40[c]	31.35[c]	0.025[d]	58.75[d]	41.64[d]	0.05
Morus	45.55[a]	49.70[a]	0.053a	95.25[a]	77.27[a]	0.39
Salix	44.55[a]	44.80[b]	0.033[b]	89.35[b]	67.67[b]	0.91
Tipuana	30.20[b]	50.05[a]	0.027[c]	80.25[c]	53.79[c]	0.16

[a,b,c,d] **Means in a row with unlike letter superscripts differ (P<0.05)**

[e] **DM basis**

DM digested within the 24 h in the rumen of sheep was 60% (*Morus*), 58% (*Salix*), 38% (*Tipuana*) and 30% (*Acacia*), respectively (Fig 2). Fraction a differ (P<0.05) significantly between *Salix* (41.35%), *Morus* (38.03%), *Tipuana* (27.25%) and *Acacia* (25.70%). The fraction of the DM potentially degraded (a+b) in the rumen, and the fractional rate of degradation (% h^{-1}) of DM (c) did not followed the same pattern, where it were higher for *Morus* (9.13 and 0.032%, respectively). Crude protein degradability of the four leaves was similar to and followed the same pattern as DM digestibility (Fig 2). In general, degradability of *Acacia* leaf CP was low in the rumen of sheep. In addition, the fraction of CP lost during wash (a), fraction of CP slowly degraded, (b), fraction of CP potentially degraded (a + b) in the rumen, were lower in the *Acacia* and *Tipuana* leaf, than in other plant forages (Table 5). The EDCP calculated for k = 3% h^{-1} particular outflow rate (ARC, 1984) was higher (P<0.05) for *Morus* (77.27%), followed by *Salix* (67.67%), *Tipuana* (53.79%) with the lowest (P<0.05) value for *Acacia* (41.64%).

The low digestion and retention of N by sheep fed *Acacia* and *Tipuana* leaves may be explained by the low in situ degradability of DM and CP. Tannins may affect the utilization of protein in forages by reducing the digestive enzymatic activity in the rumen and the intestine, and may binding feed proteins, rendering them indigestible (Ramirez and Lora, 1998).

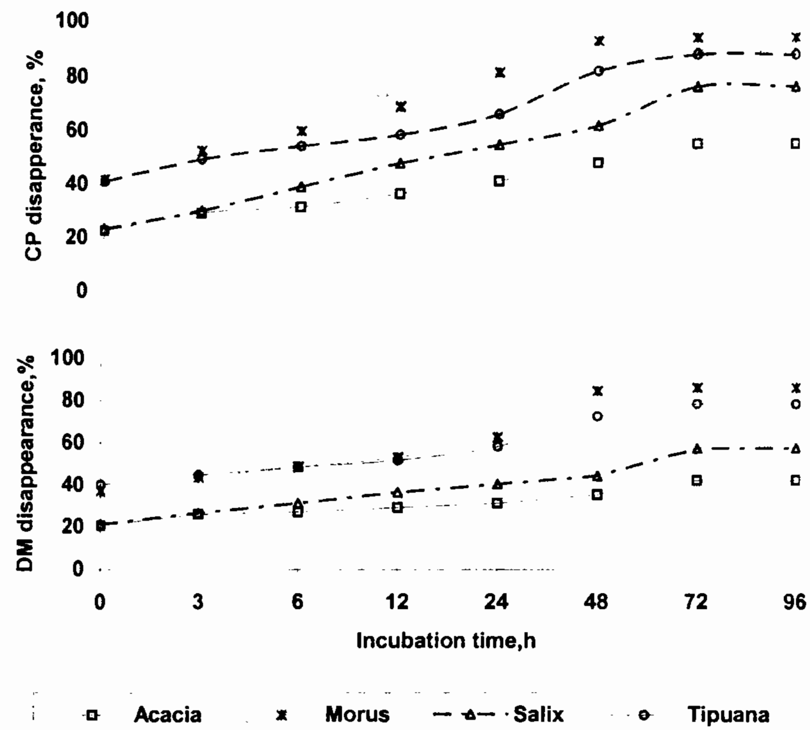

Fig (2): Dry matter (DM & CP) disapperance of plant legumes in the rumen of sheep at different incubation period's (h).

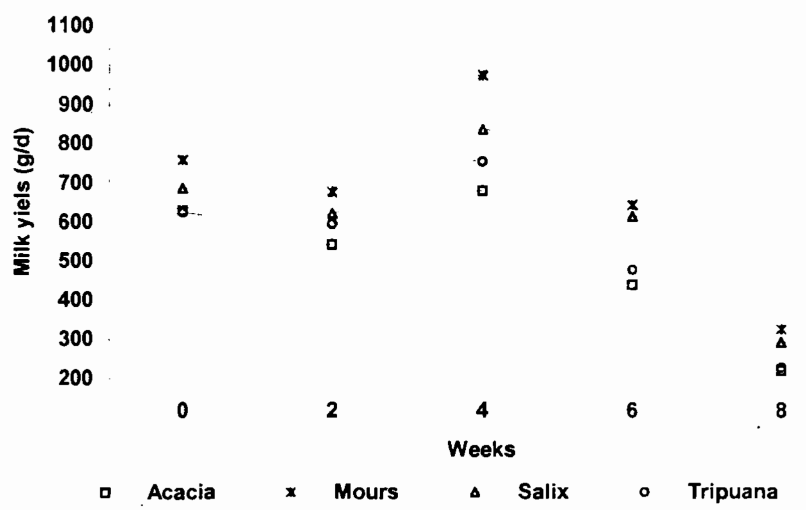

Fig (3): Milk yields of ewes fed experimental shrubs and concentrate.

Lactation study

Mean daily milk production of ewes offered *Morus plus 250 g CFM* was significantly higher (P<0.05) than other plants tested in this study Table 6 and Fig 3. Fat percentage was also higher, consequently, fat yield and 4 % FCM were higher.

Table (6): Mean daily performance of ewes offered experimental feeds and concentrate mixture.

Measure	Acacia	Morus	Salix	Tipuana
Milk yield,g/d	500 ± 11.49^{d}	675 ± 11.45^{a}	610.00 ± 19.36^{b}	535.00 ± 9.36^{c}
4% fat correc-ted milk, g/d	485 ± 9.27^{d}	792 ± 4.02^{a}	665.50 ± 20.10^{b}	626.70 ± 13.20^{c}
Milk fat, %	3.80 ± 0.48^{b}	5.16 ± 0.49^{a}	4.6 ± 0.49^{ab}	3.9 ± 0.50^{b}
Milk fat yield, g/d	19.00 ± 1.41^{c}	34.80 ± 2.21^{a}	28.10 ± 1.89^{b}	20.85 ± 2.91^{c}
Milk protein, % (N x 6.38)	3.64 ± 0.12^{b}	4.31 ± 0.15^{a}	3.70 ± 0.13^{b}	3.54 ± 0.13^{b}
Milk total solids %	14.08 ± 0.59	14.64 ± 0.64	14.47 ± 0.61	14.34 ± 0.62
Milk solids not fat , %	10.28 ± 0.18^{a}	9.48 ± 0.11^{c}	9.87 ± 0.23^{b}	10.44 ± 0.15^{a}
Milk lactose%	5.42 ± 0.06^{b}	4.22 ± 0.11^{d}	5.11 ± 0.13^{c}	5.95 ± 0.15^{a}
Milk ash , %	1.20 ± 0.06^{a}	0.96 ± 0.05^{b}	1.02 ± 0.05^{b}	1.03 ± 0.06^{b}
Zn (mg/L)	5.65 ± 0.10^{a}	3.16 ± 0.18^{b}	1.64 ± 0.12^{d}	2.37 ± 0.10^{c}
Pb (mg/L)	0.36 ± 0.01^{a}	0.20 ± 0.02^{b}	0.13 ± 0.01^{c}	0.22 ± 0.01^{b}
Cd (mg/L)	0.10 ± 0.01^{b}	0.10 ± 0.01^{b}	0.10 ± 0.01^{b}	0.16 ± 0.01^{a}
Cu (mg/L)	0.87 ± 0.01^{a}	0.66 ± 0.01^{b}	0.27 ± 0.01^{d}	0.33 ± 0.01^{c}
Cr (mg/L)	0.16 ± 0.01^{a}	0.05 ± 0.01^{c}	0.05 ± 0.01^{c}	0.10 ± 0.01^{b}

4% FCM = 0.4 x milk yield +15 x fat yield (Gaines, 1928)
a.b,c and d = Means on the same line with unlike superscripts differ (P< 0.05).

Salix leaves recorded the following higher performance of ewes regarding to milk, fat and protein production. These could be explained by the high molar of acetate produced in the rumen of sheep fed *Morus* or *Salix* leaves. Mours leaf showed an increase in 4% FCM by about 63% than *Acacia* did, where *Salix* showed 37% and *Tipuana* 29%.

It was clear that ewes fed *Acacia* had higher (P<0.05) milk content of Zn, Pb, Cu and Cr, while those fed *Tipuana* showed higher milk content of Cd. On the other hand, ewes fed on *Salix* was the less milk content of all tested heavy metals in this study.

However, *Acacia* was noted to be the less preferable plant to be used for lactating ewes, unless it is the only source for feeding, especially in the arid and semi-arid areas.

Heavy metals

Heavy metals content and its balance (Table 7) showed that, *Acacia* and *Morus* had higher (P<0.05) content of Zn, Pb , while *Tipuana* had higher (P< 0.05) Cd and Cu. Higher (P< 0.05) Cr content was noticed for *Acacia* ad *Tipuana*. *Salix* was the lowest one for its content of Zn and Cu. However all sheep fed the tested plants had positive minerals balance. The ranges of Zn, Pb, Cd, Cu and Cr of the tested plants in this study were lower than critical concentration and avoid animal toxiccoses (Underwood, 1977) on the other hand, the intake of the tested plants were adequate the mineral requirements recommended by NRC, (1985). In the mean time, milk content of the experimental minerals (Table 6) and blood (Table 8) were in the safety (William and Ganong, 1970). No significant differences were observed among sheep fed the tested plants for their blood constitutions of TP, A, G, A/G ratio, Pb and Cd (Table 8).

Table (7): Mineral contents of tested plants and their minerals balance (Mean±SE).

Item	*Acacia*	Mours	*Salix*	*Tipuana*
		Mineral Contents (mg/kg)		
Zinc	183.63 ± 2.86 ^{a}	112.53 ± 1.55 ^{b}	60.82 ± 2.10 ^{d}	79.85 ± 3.64 ^{b}
Lead	54.84 ± 1.23 ^{a}	51.45 ± 1.64 ^{ab}	32.96 ± 1.23 ^{c}	48.74 ± 1.98 ^{b}
Cadmium	5.27 ± 0.65 ^{b}	5.86 ± 0.36 ^{b}	5.58 ± 0.10 ^{b}	7.36 ± 0.26 ^{a}
Cupper	66.36 ± 1.28 ^{c}	70.50 ± 1.61 ^{b}	54.81± 2.37 ^{d}	73.83 ± 0.61 ^{ab}
Chromium	3.10 ± 0.10 ^{a}	2.52 ± 0.21 ^{b}	1.85 ± 0.16 ^{c}	3.10 ± 0.09 ^{a}
		Minerals balance (mg/h/d)		
		Zinc (Zn)		
Zn Balance	17.65 ± 1.41 ^{b}	39.56 ± 2.13 ^{a}	36.17 ± 1.33 ^{a}	8.55 ±2.10 ^{c}
% of intake	20.74 ± 1.20 ^{c}	48.82±2.44 ^{b}	64.04 ± 3.11 ^{a}	21.28 ± 1.91 ^{c}
		Lead (Pb)		
Pb Balance	18.50 ± 1.01 ^{c}	29.62 ± 0.01 ^{a}	26.18 ± 1.23 ^{b}	17.72 ± 0.87 ^{c}
% of intake	72.77 ± 2.01 ^{c}	82.00 ± 0.03 ^{b}	85.80 ± 0.34 ^{a}	72.29 ± 2.21 ^{c}
		Cadmium (Cd)		
Cd Balance	1.55 ± 0.03 ^{d}	3.55 ± 0.13 ^{b}	4.57 ± 0.01 ^{a}	3.00 ± 0.02 ^{c}
% of intake	63.50 ± 1.00 ^{d}	86.37 ± 1.34 ^{ab}	88.22 ± 1.02 ^{a}	81.08 ± 1.11 ^{c}
		Cupper		
Cu Balance	20.57 ± 0.01 ^{d}	39.80 ± 1.01 ^{b}	43.02 ± .23 ^{a}	25.78 ± 1.23 ^{c}
% of intake	66.79 ± 0.98 ^{d}	80.42 ± 1.16 ^{b}	84.53 ± 1.19 ^{a}	69.45 ± 1.14 ^{c}
		Chromium		
Cr Balance	0.57 ± 0.01 ^{d}	1.19 ± 0.04 ^{a}	1.11 ± 0.01 ^{b}	0.80 ± 0.02 ^{c}
% of intake	39.58 ± 0.21 ^{d}	67.61 ± 1.43 ^{a}	64.53 ± 0.12 ^{b}	51.61± 0.97 ^{c}

a,b,c and Means on the same time with unlike superscripts differ (P<0.05).

Higher (P<0.05) urea content was seen by *Morus* and *Salix*, this could be related to the Zn effect. However, the biochemical parameters in the blood of sheep fed the experimental plant were in the normal blood analytic values in animals (William and Ganong, 1970)

CONCLUSION

As the minimal crude protein level of dry material for maintenance of sheep has been indicated by Milford and Haydock (1965) to be 7.2%, however, the Untied States National Academy of Sciences (1975) suggest that at least 8.9% crude protein in plant materials is required. The protein value of the plants in this study were mostly well above the recommended levels, suggesting that they should not maintain animals but they also tended to have production potentially as well.

So, they can be used as the only source of fodder especially with *Morus* or *Salix* shrubs, but with *Acacia* it should be supplemented with any source of energy as *Acacia* is a salt-tolerant plant which would provide insufficient energy for sheep (Norton, 1982). However, if the animals were adapted to forage of low quality, these *Acacia* or *Tipuana* would probably be of some use at least at the maintenance level.

Table (8) : Blood biochemical parameters of sheep fed the experimental plant legumes.

Item	*Acacia*	*Morus*	*Salix*	*Tipuana*
Total protein (g/100ml)	6.37 $\pm$0.14	6.16$\pm$0.12	6.26$\pm$0.18	6.41$\pm$0.23
Albiumin (Al) (g/100ml)	4.49$\pm$0.06	4.36$\pm$0.17	4.40$\pm$0.21	4.42$\pm$0.08
Globulin (Gl) (g/100ml)	1.88 $\pm$0.08	1.80$\pm$0.06	1.86$\pm$0.06	1.94$\pm$0.05
A/G ratio	2.39 $\pm$0.22	2.42$\pm$0.21	2.36$\pm$0.23	2.27$\pm$0.12
Urea (mg/100ml)	8.21$\pm$0.31^{b}	9.10$\pm$0.12^{a}	8.86$\pm$0.17^{a}	8.30$\pm$0.20^{b}
Creatinine (mg/100ml)	0.88$\pm$0.02	0.86$\pm$0.02	0.75$\pm$0.01	0.80$\pm$0.03
AST (mg/100ml)	24.67$\pm$0.43^{a}	20.84$\pm$0.12^{c}	25.36$\pm$0.36^{a}	22.67$\pm$0.18^{b}
ALT (mg/100ml)	30.15$\pm$0.66^{c}	34.26$\pm$0.28^{a}	32.06+0.21^{b}	32.73$\pm$0.36^{b}
Zn (mg/L)	3.31$\pm$0.10^{a}	2.60$\pm$ 0.10^{b}	1.26$\pm$0.10^{d}	1.63$\pm$0.01^{c}
Pb (mg/L)	0.10$\pm$0.01	0.10$\pm$0.01	0.10$\pm$0.01	0.10$\pm$0.01
Cd (mg/L)	0.10$\pm$0.01	ND	ND	0.10$\pm$0.01
Cu (mg/L)	0.22$\pm$0.01^{b}	0.10$\pm$0.01^{c}	0.10$\pm$0.01^{c}	0.26$\pm$0.01^{a}
Cr (mg/L)	0.10$\pm$0.01^{a}	ND	0.03$\pm$0.01^{c}	0.06$\pm$0.01^{b}

a,b,c and Means on the same time with unlike superscripts differ ($P<0.05$).
ND=not detected

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REFERENCES

Abdel Basit, A. and Fatma A., Hassan (2000). Feeding value of some forage (trees) grow in the north coast and their effect on sheep performance. Egypt. J.Appl. Sci., 15 (12): 374-383.

AOAC (1990). Official Methods of Analysis. 15th Ed. Association of Analytical Chemists, Washington, DC.

ARC (1984). Agricultural Research Council. The Nutrient Requirement of Ruminant Livestock. Commonw. Agric. Bur. Farnham Royal. Engl.

Ash , A. J. (1990). The effect of supplementation with leaves from the leguminous trees Sesbania grandiflora, Albizia chinensis and Gliricidia sepium on the inake and digestibility of guinea grass hay by goats. Anim. Feed Sci. Technol. 28:225-232.

Barry, T. N.; T.R. Manley and S.J. Duncan (1986). The role of condensed tannins in the nutritional value of Lotus pedunculatus for sheep. 4. Sites of carbohydrate and protein digestion as influenced by dietary reactive tannin concentration. British J. of Nutri., 55:123-137.

Benavides, J. and D. Pezo (1986). Evaluacion del crecimientso y consumo de materia seca en corderos alimentados con follaje de poro (E. poeppigana) ad lib supplementadas con distintas fuentes de energia.

Bhattacharya , A.N. (1989). Nutrient utilization of *Acacia* , Haloxylon , and Atriplex species by Najdi sheep. J. Range Manag. 42:28-31.

Burns, R.E., 1971. Method for estimation of tannin in sorghum grain. Agron. J. 36:511-515.

Conway, E.J. (1962). Microdiffusion Analysis and Volumetric Errors. 5th. Edn. Crosby Lockwood- London.

El-Shaer, H., S.S. Tag El-Din and H.M.Kandil (1984). Nutritive evaluation of some introduced pasture plants in North Sinai. 1st Egyptian Brit. Conf. On Animal and Poultry Production. Zagazig, Egypt, 2:312-320.

FAO, 1998. Animal Feed Resourses Information System, 8th Edition- From the original book named Tropical Feeds by Bo Gohl – database by Andrew Speedy and Nick Waltham. FAO, Rome.

Faulkner, W.R. and J.W King (1976). Fundamentals of clinical chemistry. 2 nd Ed., (NW Tietz, ED.), Saunders, Phliadephia., PP. 994-998.

Fick, D.R.; L.R., McDowell, P.H. Miles, N.S. Wilkinson, J.D. Funk and J.H. Conrad (1979). "Methods of Mineral Analysis for Plant and Animal Tissues". 2 nd Animal Science Dept. Univ. Florida; Gainesville, USA.

Gaines, W.L. (1928). The energy basis of measuring milk yield in dairy cows. Illinios Agric. Exp. Stn. Bull. ? 308.

Galatov, A.N. (1994). The effect of crossbreeding on milk production of fine wool ewes. Animal Breed Abst. 62:211.

Goering, H.K. and P.J. Van Soest (1970). Forage fiber analysis (apparatus, reagents, procedures, and some applications). In: USDA Agricultural Handbook No. 379. pp. 1-20.

Goodchild, A.V. and N.P., McMeniman (1994). Intake and digestibility of low quality roughages when supplemented with leguminous browse. J. Agric. Sci., 122:151-160.

Hafez, S.I. and Fatma, A.H. (2001). Some legume shrubs and trees as sources for animal feed in the north coast of Egypt. Egyptian J. Nutrition and Feeds. 4: 569-580

Henery, J.B. and S.D Todd. 1974. Clinical Diagnosis and measurment by Laboratory Method. 16 th ED., W.B. Saunders and Co., Phliadephia., PA. P.260.

Henry, R.J.,; D.C. Cannon and J. W. Winkelman (1974). Clinical Chemistry: Principals and Techniques, 11 th ED., Happer and Row Publishers PP. 1629

Holechek, J.L.; A.V. Munshikpu, L. Saiwana., G. Nunez-Hernandez, R., Valdez, J.D. Wallace and M. Cardenas (1990). Influences of six shrubs diets varying in phenol content on intake and nitrogen retention by goats. Trop. Grass. 24:91-98.

Jouany, J.P. (1982). Doasage des acides gras volatils dans les contenus digeslifs, less jus densilage, les cultures bacteriennes et les contenus de fermenteurs aerobies. Sciences des Aliments, 2: 131-144.

Lefroy, E.C.; P.R. Dann, J.H., Wildın, R.N., Wesley-Smith and A.A. McGowan (1992). Trees and shrubs as sources of fodder in Australia. Agroforesty Systems., 20:117-139.

Liu, J.X.; J. Yao, B. Yan, J.Q. Yu and Z.Q.Shi (2001). Effect of mulberry leaves to replace rapeseed meal on performance of sheep feeding on ammoniated rice straw diet. Small Rumin. Res., 39:131-136.

Maharem, G.M. and Eman Ismail (2002). Effect of Feeding *Acacia Saligna* and Prosopis juliflora on productivity and hemato-biochemical constituents of blood in lactating goats. Alex. J.. Agric. Res., 47 (1): 17-25.

Maynard, L. A.; J.K. Loosli, H.F. Hintz and R.G. Warner (1979). Animal Nutrition (7 th Ed.). Mc Graw – Hill Book CO., New York.

Milford, R. and K.P. Haydock, 1965. Nutritive value of protein in subtropical pasture species grown in south east, Queenstand – Australian. J. Experimental Agric. Anim. Husb., 5:13-17.

Nantoume, H.; T.D.A. Forbes, C.M. Hensarling and S.S. Sieckenius (2001). Nutritive value and palatability of guajillo (*Acacia* berlandieri) as a component of goat diets. Small Rumen. Res., 40:139-18.

Norton, B.W. (1982). Differences between species in forage quality. In Nutritional Limits to animal production from pastures (Ed. J.B.Hacker) pp 89-110. (Commonwealth Agricultural Bureaux: Farnham Royal, U.K.).

Norton, B.W.and M.H. Waterfall (2000).The nutritive value of *Tipuana* tipu and Calliandra calothyrsus as supplements to low-quality straw for goats. Small Ruminant Research, 38:175-182.

NRC (1985). National Research Council. Nutrient requirements of sheep. 6^{th} Revised Ed., National Academy of Science. Washington, USA.

Orskov, E.R. and I. McDonald (1979). The estimation of protein degradability in the rumen from incubation measurments weighd according to rate of passage. J.Agric. Sci. Cambrige., 92:499-503.

Price, M.L.; S., Van Scoyoc and L.G. Butler (1978). A critical evaluation of the vanillim reaction as an assay for tannin in sorghum grains. J.Agric. Food Chem., 26:1214-1220.

Rafique, S.; J.D. Wallace, J.L. Holechek, M.L. Galyean and D.P. Arthur (1992). Effect of forb and shrubs diets on ruminant nitrogen balance: I. Sheep studies. Small Rumin. Res., 45:113-122.

Ramirez, R.G. and J.A. Lara (1998). Influence of native shrubs *Acacia* rigidula, Ceridium macrum and *Acacia* farnesiana on digestibility utilization by sheep. Small Rumin. Res., 28:39-45.

Reed, J.D.; H. Soller and A. Woodward (1990). Fodder trees and straw diets for sheep intake, growth , digestibility and the effect of phenolics on nitrogen utilization. Anim. Feed Sci. Technol., 30:39-50.

Reitman, S. and S.A. Frankel (1957). Colorimetric method of determination of serum glutamic oxaloacetic and glutamic pyrovic transaminase. Am. J. Clin.Pathl., 28:56-63.

Roothaert, R.L. and R.T. Paterson (1997). Recent work on the production and utilization of tree fodder in East Africa. Anim. Feed Sci. Technol, 69:39-51.

SAS (1988). SAS User's Guide: Statistical analysis Systems Institute, Cary, NC, pp.125-154.

Satter, L.D. and L.L. Slyter (1974). Effect of ammonia concentration on rumen microbial protein production in vitro. Br.J. Nutri., 32:199-208.

Seligman, N.G.; R.W. Benjamin and I., Spharim (1989). Multiple goal feasibility of forage shrub plantations in a semi-arid Mediterranean-type agropastoral system- Agricultural Systems, 30:335-350.

Sharon, M; McCabe and T.N. Barry (1988). Nutritive value of willow (*Salix* sp.) for sheep, goats and deer. J.Agric. Sci. Camb., 111:1-9.

Smith,O.B. (1994). Using fodder from trees and shrubs to feed livestock in the tropics. Better Farming Series 42, FAO, Rome

Steel, R.G.D. and R.A. Torrie (1980). Principles and Procedures of Statistics. McGraw-Hill , New Yourk, pp.137-167.

Topps, J.H. (1992). Potential, composition and use of legume shrubs and trees as fodder for livestock in the tropics. J. Agric. Sci. Cambridge. 118:1-8.

Underwood, E.G.(1977). Trace elements in Human and Animal Nutrition . 4th. Ed., Academic Press, New York, USA.

United States National Academy of Sciences (1975). Nutrient requirements of domestic animals. No.5. Nutrient requirements of sheep (5th revised edition.) (National Research Council : Washington , DC.).

Waghorn, G.C.; M.J. Ulyatt; A. John and M.T.Fisher (1987). The effect of condensed tannins on the site of digestion of amino acids and other nutrients in sheep fed Lotus corniculatus. British J. of Nutri. 57:115-126.

Wintrob, M.M. (1965). Clinical Hemotology. Fourth edition. Lea and Febiger company, Philadelphia, p.411.

William,F. and M.D. Ganong (1970). Review of Medical Physiology. 9th Ed. LANGE, Medical Pub. San Francisco, California, USA.

Yao, J.; B. Yan, X.Q., Wang and J.X. Liu (2000). Nutritional evaluation of mulberry leaves as feeds for ruminants Livestock. Res for Rural development, 12 (2).

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تأثير الأكاسيا ساليجنا ، المورس نيجرا ، الساليكس تيتراسبيما و التيبيوانا تيبـو عل الهضم و اختفاء المادة الجافة و البروتين في الكرش و انتـاج اللبـن فـي الأغنام.

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أجريت هذه الدراسة بزراعة أربعة نباتات شجيرية (الأكاسيا ، المـورس ، السـالكس ، التيبوانا) تحت الظروف الصحراوية و تروى بمياه الصرف بمدينة برج العرب و قسمت الدراسة إلى تجربتين رئيسيتين:

الأولى بهدف التقييم الغذائي و موازين الأزوت و عناصر الزنك و الرصاص و الكادميوم و النحاس و الكروميوم باستخدام كباش خليطة (سافولك × برقى) كما استخدم ٣ كباش مـزودة بفتحة مستديمة بالكرش لتقدير نشاط الكرش فى حين استخدمت ٣ نعاج مزودة بفتحـة مسـتديمة بالكرش لتقدير معدلات اختفاء المادة الجافة و البروتين من الكرش باسـتخدام طريقـة الأكيـاس النايلون. و فى الثانية تم تغذية نعاج برقى (عشار ٣ شهور) على النباتات المختبرة (تغذية حـرة) بالإضافة إلى كمية ٢٥٠ جم علف مركز للرأس يوميا على فترتين (٧ صباحا و ٤ مساء) لتقدير اللبن المنتج يوميا مع تحليل مكوناته هذا و قد تم أخذ عينات من دم الأغنام لتقدير مكونات الـدم و تركيزات العناصر المعدنية الثقيلة المختبرة و كذلك فى اللبن. أظهرت النتائج ارتفـاع معـدلات اختفاء المادة الجافة و البروتين بكرش الأغنام المغذاة على المورس (التوت) و ارتفاع معـاملات الهضم و ميزان الازوت مقارنة بباقى النباتات مع زيادة رقم الأس الأيدروجينى فى حالة التغذيـة على الأكاسيا و التيبوانا مع انخفاض تركيز أمونيا الكرش فى حالة الأولى مـع زيـادة تركـيز الأحماض الدهنية الطيارة و على الأخص حمض الخليك فى حالة التغذية على نبات المـورس (التوت) و زيادة حمض البروبيونك مع الأكاسيا و الساليكس (الصفصـاف) و ارتفـاع حمـض البيوتريك مع التيبوانا كما أظهرت النتائج أن النعاج المغذاة على نبات التوت قد أنتجت كمية مـن اللبن أكثر من باقى النباتات الأخرى مع زيادة مكونى اللبن من الدهن و البروتين و قد زاد تركـيز عناصر الزنك و الرصاص و النحاس و الكروميوم فى اللبن أيضا فى حين أن لبن الأغنام المغذاة على التيبوانا زاد به تركيز الكادميوم و أن التركيزات بصفة عامة فى حدود المستويات الطبيعيـة هذا و لم تكن هناك فروق معنوية بين الأغنام فى تركيزات الدم من البروتين الكلى الألبيوميـن و الرصاص و الكادميوم.

أوضحت هذه الدراسة إمكانية اعتماد الأغنام فى تغذيتها فى مناطق الاسـتصلاح علـى نباتى المورس (التوت) و الساليكس (الصفصاف) كعلف أخضر بهدف تغطيـة احتياجاتـها مـن الأعلاف الخضراء و سد جزء من الفجوة الغذائية فى مناطق الساحل الشمالى من مصر خاصـة تلك التى تروى بمياه الصرف الصحى و تأتى التيبوانا فى الدرجة الثالثة فى حين يجب الاهتمـام بتقديم أى مصدر للطاقة فى حالة اللجوء لتغذية الأغنام على نباتات الأكاسيا.