RESULTS

5.1 Introduction

It was observed from the two years studies that the types and quantities of feeds eaten by the animals varied from one deer farm to another and in a number of cases the differences can be obvious (see Table 5.1). It appears that deer in captivity tend to have their own preferential diet which differ from one farm to the other (Table 5.1).

Deer like to eat throughout the day. Ruminations were normally done under the shades especially during hot sunny day (see Plate 5.1). There are various parts of the plants other than the leaves that were eaten by deer including stolons, shoots, twigs and occasionally stems (soft parts of the tree). In certain cases, the animals also ate fallen tree leaves especially in primary forest where most of the plants were tall trees (Ahmad Shuhaimi, per. comm.)

Palatable plants consumed in the area include weeds, legumes, grasses, tree leaves and shrubs. Most of these plants were not cultivated in the paddock but which grew widly in a pattern typical of secondary forest growth. In a number of farms deer were found capable of tolerating thorny plants available in the area (e.g. *Mimosa invisa)* but in other farm, this plant may cause injury to the deer mouth and the animal eventually die because they could not eat properly (Rashid, per. comm.). Pellet were normally offered in small quantities and was used both as a mean to facilitate human-animal interactions and as feed supplement to the animals.

Plate 5.1 : The Parit Baru deer farm, Selangor

Plate 5.2 : Island of trees in Segamat deer farm

Area / Sample	*Acacia mangium*	*Artocarpus integra*	*Asystasia gangetica*	*Barringtonia racemosa*	*Calopogonium mucunoides*	*Centrosema pubescens*	*Ficus hispida*	*Fragraea fragrans*	*Ipomoea aquatica*	*Melastoma malabathricum*	*Mikania micrantha*	*Mimosa invisa*	*Morinda citrifolia*	*Mussaenda erythrophylla*	*Panicum maximum*	*Pennisetum purpureum*	*Phyllanthus indica*	*Sapium baccatum*	*Trema orientalis*
Parit Baru, Selangor[1]									x				x				x		
Sg. Besar, Selangor[1]																x			
Siliau, N. Sembilan[1]	x		x												x				
Serting, N. Sembilan[2]					x										x				
Juasseh, N. Sembilan[2]															x				
T. Tasik Perdana, KL[3]			x					x	x	x	x			x				x	
Datai, Langkawi[2]			x	x															x
Segamat, Johor[2]	x		x			x									x			x	x
Sg. Siput, Perak[1]			x				x				x	x				x			
Ulu Kati, Perak[4]			x		x	x	x			x	x								
Behrang, Perak[1]	x	x	x													x			
Sekayu, Terengganu[5]											x							x	x
Gua Musang, Kelantan[5]																		x	x

Note

1 - DVS deer farm

2 - Private deer farm

3 - DBKL deer farm

4 - Individual deer farm

5 - Government deer farm

Table 5.1: Plant availability in various deer farms in Malaysia

SCIENTIFIC NAME	VERNACULAR NAME	FAMILY
Acacia mangium	Acacia	Leguminosae
Alternanthera triandra	Kermak	Amarantaceae
Artocarpus integra (heterophyllus)	Nangka	Urticaceae
Asystasia gangetica (intrusa)	Rumput Israel/Pengorak	Acanthareae
Barringtonia racemosa	Putat	Lecythdaceae/ Myrtaceae
Bracharia mutica	Paragrass	Poaceae
Calopogonium muconoides	Calopo	Papilionaceae
Centrosema pubescens	Centro	Papilionaceae
Dipalazium esculentum	Pucuk paku	Polypodiaceae
Ficus hispida	Ara kelempung	Moraceae
Fragraea fragrans	Tembusu padang	Loganiaceae
Gnetum gnemon	Belinjau/Daun sho	Gnetaceae
Gynandropsis gynandra	Maman	Cappardiaceae
Hibiscus rosa – sinensis	Bunga raya/hibiscus	Malvaceae
Homalanthus populifolius	Mahang rusa/mamah pelanduk	Euphorbiaceae
Hyptis brevipes	Sawi enggang	Labiateae
Ipomoea aquatica (reptans)	Kangkung	Con volvulaceae
Leuceana leucocephala	Petai belalang/Ipil - ipil	Leguminoceae
Melastoma malabathricum	Senduduk	Melastomataceae
Mikania micrantha	Selaput tunggul/Ulam tikus	Asteraceae
Mimosa invisa	Mimosa/Duri Semalu	Mimosaceae
Morinda citrifolia	Mengkudu	Rubiaceae
Moringa oleifera (pterygosperma)	Remunggai/Merungai/Kacang kelo	Moringaceae
Mussaenda erythrophylla	Janda kaya/ Janda berhias	Rubiaceae
Neptunia oleraceae	Tangki air/ Keman puteri	Euphorbiaceae
Ocimum basilicum	Kemangi	Labiataceae
Panicum maximum	Rumput Guinea/rumput benggala	Poaceae
Pdermachera gigantia	Setenggek burung	Connaraceae
Pennisetum purpureum	Rumput gajah/Napier	Poaceae
Pluchea indica	Beluntas	Compositae
Premna cordifolia	Bebuas	Verbenaceae
Sapium baccatum	Ludai/Maya	Euphorbiaceae
Saudropus androgynus	Pucuk manis /Cekur manis	Euphorbiaceae
Sesbania grandiflora	Turi/Geti	Caesalpiniaceae
Solanum nigrum	Meranti	Solanaceae
Stenachlaena palustris	Pucuk paku merah/paku mending	Polypodiaceae
Trema orientalis	Mengkirai	Ulmaceae

Table 5.2 : List of plant samples

5.2 Plant selection

A total of 80 plants samples were collected from various sites inhabited by rusa deer (*Cervus timorensis)* during the course of study. Only 37 plant species (see Table 5.2) were subjected to detail analysis whereas the rest were not able to be identified to species level. Some of these unidentified plants were listed in Appendix E. The 37th plants were grouped into three categories i.e. weeds, trees and shrubs (Table 5.3). Three grass species *(P. maximum, P. purpureum* and *B. mutica)* and two legumes species *(C. mucunoides* and *C. pubescens)* were also sampled in the studies for comparison. These grasses and legumes grow readily in most deer farms in Malaysia.

Table 5.3 : Classification of browse plants consumed by rusa deer in captivity

SHRUBS	TREES	WEEDS
Althernanthera triandra	*Acacia mangium*	*Asystasia gagentica*
Barringtonia racemosa	*Artocarpus integra*	*Gynandropsis gynandra*
Dipalazium esculentum	*Fragreae fragrans*	*Hyptis brevipes*
Ficus hispida	*Gnetum gnemon*	*Melastoma malabathricum*
Hibiscus rosa-sinensis	*Moringa oleifera*	*Mikania micrantha*
Ipomoea aquatica	*Pdermachera gigantia*	*Mimosa invisa*
Morinda citrifolia	*Sesbania grandiflora*	
Mussaenda erythrophylla	*Solanum nigrum*	
Ocimum basilicum	*Homalanthus populifolius*	
Pluchea indica	*Leuceana leucocephala*	
Premna cordifolia	*Neptunia oleraceae*	
Sapium baccatum		
Saudropus androgynus		
Stenachlaena palustris		
Trema orientalis		

The classified plants were then separated according to plants that were already known

eaten by the animals (see Table 5.4) and plants which have the potential to be introduced as deer feed (see Table 5.5).

5.3 Chemical contents of forages

Chemical contents in the plants were analysed using Proximate Analysis (PA) and fibre detergent system.

5.3.1 Proximate analysis

The chemical content of the plants analysed are listed in Table 5.6. The DM content ranged from 10 % (*Stenachlaena palustris*) to 33 % (*Melastoma malabathricum*). Fifteen plants contained DM of between 10 % - 19 % whereas ten plants had DM ranging from 20 % - 29 %. The highest DM value were above 30% in 7 plants.

CP level in plants should be above 8% to make it suitable to be offered as plant protein supplement (Church, 1982). In certain cases, 7% of CP may serve as the minimum amount needed by deer in captivity (Urness,1969) and 13% of CP were recommended for deer (Short, 1971). Most plants had CP value above the optimum level with the exception of the *Ocimum basilicum* which has only 7.89% of CP. *Neptunia oleraceae* has the highest CP recorded (45.32%). Three of the 37 forages, contained less than 13% of CP. *Stenachlaena palutris*, *Moringa oleifera* and *Hibiscus rosa-sinensis* with CP > 38 % show great promises as apparently valuable plant sources of nitrogen.

The CF level in the plants ranged from 6.27% (*Dipalazium esculentum*) to 42.08% (*Acacia mangium*) (average = 24%). *Brachiaria mutica*, *Ipomoea aquatica* and especially *Acacia mangium* were high in CF content and these plants can be used

Table 5.4 : Plants which were known eaten by rusa deer (*Cervus timorensis*) in captivity

Samples/Species	DM (%)	CF (%)	CP (%)	EE (%)	Ash (%)	NFE (%)	Ca : P
Acacia mangium	24.81 ± 1.95	42.08 ± 1.73	30.51 ± 1.73	5.17 ± 0.57	4.54 ± 1.41	19.69 ± 1.10	8.8 : 1
Artocarpus integra	28.87 ± 4.39	16.26 ± 2.10	22.62 ± 2.22	3.27 ± 0.61	7.92 ± 0.66	49.94 ± 2.98	1.5 : 1
Asystasia gangetica	15.35 ± 3.03	12.95 ± 0.50	18.05 ± 4.20	2.76 ± 0.83	16.99 ± 1.99	39.57 ± 6.28	4.4 : 1
Ficus hispida	25.71± 4.26	36.27 ± 5.45	14.64 ± 1.84	2.43 ± 0.11	16.07 ± 0.17	26.47 ± 6.00	13.1 : 1
Fragraea fragrans	30.62 ± 2.00	20.77 ± 7.41	11.30 ± 1.22	2.89 ± 0.12	4.85 ± 0.08	60.19 ± 2.21	5.2 : 1
Homalanthus populifclius	32.29 ± 5.62	15.70 ± 0.80	30.37 ± 8.85	2.42 ± 1.43	6.79 ± 0.12	44.72 ± 3.36	6.3 : 1
Ipomoea aquatica	12.48 ± 1.34	30.85 ± 0.13	27.63 ± 0.59	3.49 ± 0.70	13.77 ± 0.31	15.25 ± 0.43	1.6 : 1
Leuceana leucocephala	28.46 ± 0.82	16.14 ± 2.30	23.14 ± 0.91	5.54 ± 0.23	7.13 ± 0.58	27.87 ± 3.82	4.4 : 1
Melastoma malabathricum	33.82 ± 0.82	20.39 ± 0.70	25.33 ± 0.68	1.52 ± 0.57	9.97 ± 0.23	42.78 ± 1.07	15.4 : 1
Mikania micrantha	14.14 ± 1.40	20.70 ± 3.21	34.20 ± 9.59	3.20 ± 0.69	11.20 ± 1.73	30.70 ± 5.46	7.8 : 1
Mimosa invisa	28.71 ± 0.90	26.19 ± 9.52	23.23 ± 5.48	2.51 ± 0.65	3.68 ± 0.42	44.39 ± 3.39	1.6 : 1
Morinda citrifolia	15.32 ± 3.11	12.94 ± 0.90	18.23 ± 6.28	3.23 ± 0.31	8.29 ± 0.19	49.32 ± 7.22	1.2 : 1
Moringa oleifera	22.91 ± 1.71	22.86 ± 1.12	39.21 ± 0.98	4.53 ± 0.73	8.00 ± 1.79	27.28 ± 2.06	5.2 : 1
Pluchea indica	31.24 ± 6.03	8.86 ± 0.17	26.40 ± 0.78	3.08 ± 0.81	9.53 ± 0.55	52.13 ± 1.32	1.3 : 1
Sapium baccatum	31.24 ± 6.03	22.99 ± 1.23	8.69 ± 3.49	4.27 ± 1.43	5.20 ± 0.29	58.85 ± 5.98	5 : 1
Trema orientalis	32.61 ± 0.80	13.60 ± 1.89	14.37 ± 0.80	1.85 ± 0.37	9.64 ± 0.89	60.54 ± 0.50	5.2 : 1

Table 5.5 : Plants with high potentials as rusa deer (*Cervus timorensis*) feed

Samples/Species	DM (%)	CF (%)	CP (%)	EE (%)	Ash (%)	NFE (%)	Ca : P
Althernanthera triandra	14.84 ± 2.40	16.18 ± 3.21	36.41 ± 1.71	2.16 ± 0.62	14.21 ± 4.96	31.05 ± 6.29	1.5 : 1
Barringtonia racemosa	17.51 ± 0.62	10.83 ± 0.98	22.71 ± 2.05	2.03 ± 0.32	8.32 ± 0.92	55.48 ± 1.38	0.4 : 1
Dipalazium esculentum	15.34 ± 4.32	6.27 ± 1.14	29.94 ± 5.60	3.77 ± 0.89	14.22 ± 1.38	46.30 ± 5.89	0.2 : 1
Gnetum gnemon	19.20 ± 2.69	8.54 ± 2.25	26.40 ± 3.74	2.14 ± 0.20	7.50 ± 1.28	55.38 ± 7.22	1.5 : 1
Gynandropsis gynandra	11.79 ± 3.77	15.91 ± 0.18	13.48 ± 2.63	1.27 ± 0.60	6.90 ± 3.04	62.43 ± 1.70	1.4 : 1
Hibiscus rosa-sinensis	20.50 ± 0.80	8.95 ± 0.37	39.15 ± 9.85	5.01 ± 1.84	12.70 ± 0.14	33.99 ± 7.64	3.6 : 1
Hyptis brevipes	10.54 ± 2.52	11.35 ± 0.44	24.63 ± 7.44	3.51 ± 0.62	17.58 ± 0.63	42.93 ± 7.16	1.4 : 1
Mussaeanda erythrophylla	19.79 ± 5.92	16.57 ± 3.21	26.93 ± 2.30	1.90 ± 0.63	9.50 ± 0.67	45.11 ± 3.53	2.1 : 1
Neptunia oleraceae	19.69 ± 0.03	9.52 ± 1.03	45.32 ± 2.13	4.41 ± 0.80	7.32 ± 0.04	28.18 ± 3.08	1 : 1
Ocimum basilicum	19.19 ± 1.02	7.81 ± 2.00	7.89 ± 1.23	5.41 ± 0.15	13.11 ± 0.26	65.78 ± 3.29	1.2 :1
Pdermachera gigantia	24.69 ± 0.93	17.37 ± 2.00	18.82 ± 8.12	4.27 ± 0.74	7.24 ± 0.88	52.30 ± 9.55	0.8 :1
Premna cordifolia	18.70 ± 2.27	12.19 ± 0.24	26.80 ± 3.73	3.42 ± 0.90	7.85 ± 1.21	49.74 ± 1.30	1.2 :1
Saudropus androgynus	24.46 ± 0.44	9.32 ± 0.34	23.42 ± 2.61	5.44 ± 2.33	9.74 ± 0.40	52.08 ± 2.85	0.5 :1
Sesbania grandiflora	22.68 ± 4.10	32.26 ± 5.90	21.13 ± 5.56	3.43 ± 0.20	5.85 ± 3.12	44.99 ± 3.57	1.5 : 1
Solanum nigrum	32.40 ± 2.96	32.70 ± 5.55	16.62 ± 6.18	3.22 ± 1.06	13.64 ± 0.46	36.15 ± 2.35	1.5 :1
Stenachlaena palustris	10.43 ± 0.16	8.00 ± 4.70	40.18 ± 6.05	1.34 ± 0.64	11.62 ± 0.09	38.86 ± 8.19	0.2 : 1

as potential valuable source of energy.

The ether extract (EE) or crude fat content in plants ranged from 1.27% (*Gynandropsis gynandra*) to 5.54% (*Leuceana leucocephala*). The ash level which mostly constitute mineral content in plants were high as the lowest were 3.68 % in *Mimosa invisa* to 17.58% in *Hyptis brevipes*. The NFE level in the plants was detected lowest in *Ipomoea aquatica* (15.25%) and highest in *Trema orientalis* (60.54 %).

The chemical composition for different classes of plants were listed in Table 5.6 - a to Table 5.6 - e. Table 5.6 - a shows the variation in proximate composition in eight of the selected tree leaves. *Acacia mangium* has the highest CF and EE content but lowest in ash and NFE content. *Gnetum gnemon* also showed the lowest level in DM, CF and EE. The highest level in DM and ash were in *Solanum nigrum*. *Fragreae fragrans* demonstrated a low CP content but high in NFE content. Three other tree leaves; *Artocarpus integra, Pdermachera gigantia* and *Sesbania grandiflora* showed average chemical composition compared to those previously mentioned.

Out of 16 shrubs in Table 5.6 - b, 6 plants showed DM ranging from 10.43% (*Stenachlaena palustris*) to 32.61% (*Trema orientalis*). *Ocimum basilicum* has a very low CP (7.89%) compares to *Stenachlaena palustris* with 40.18 %. The highest CF was in *Ipomoea aquatica* with 39.86 % and the lowest was in *Dipalazium esculentum* (6.27%). *Stenachlaena palustris* shows the lowest in EE with 1.34% compared to the highest, 5.44% in *Saudropus androgynus*. As for ash content, *Sapium baccatum* had the lowest and *Ficus hispida*, the highest (16.07%). *Ipomoea aquatica* (15.25%) had the lowest NFE while the highest was recorded in *Ocimum basilicum* (65.78%).

Sample/Species	DM (%)	CP (%)	CF (%)	EE (%)	Ash (%)	NFE (%)
Acacia mangium	28.41 ± 1.95	30.51 ± 1.28	42.08 ± 1.73	5.17 ± 0.59	4.54 ± 1.41	19.69 ± 1.10
Artocarpus integra	28.87 ± 4.39	22.62 ± 2.22	16.26 ± 2.10	3.27 ± 0.61	7.92 ± 0.66	49.94 ± 2.98
Fragraea fragrans	30.62 ± 2.00	11.30 ± 1.22	20.77 ± 7.41	2.89 ± 0.12	4.85 ± 0.08	60.19 ± 2.21
Gnetum gnemon	19.20 ± 2.69	26.40 ± 3.74	8.54 ± 2.25	2.14 ± 0.20	7.50 ± 1.28	55.38 ± 7.22
Moringa oleifera	22.91 ± 1.71	39.21 ± 0.98	22.86 ± 1.12	4.53 ± 0.73	8.00 ± 1.79	27.28 ± 2.06
Pdermachera gigantia	24.69 ± 0.93	17.37 ± 2.00	18.82 ± 8.12	4.27 ± 0.74	7.24 ± 0.88	52.30 ± 9.55
Sesbania grandiflora	22.68 ± 4.10	32.26 ± 5.90	21.13 ± 5.56	3.43 ± 0.20	5.85 ± 3.12	44.99 ± 3.57
Solanum nigrum	32.40 ± 2.96	32.70 ± 5.55	16.62 ± 6.18	3.22 ± 1.06	13.64 ± 0.46	36.15 ± 2.35
Average	26.22 ± 2.59	20.89 ± 4.31	26.55 ± 2.86	3.62 ± 0.53	7.44 ± 1.21	43.24 ± 3.88

Table 5.6 - a : Proximate analysis of selected tree leaves

Sample/Species	DM (%)	CP (%)	CF (%)	EE (%)	Ash (%)	NFE (%)
Calopogonium mucunoides	33.22 ± 2.69	20.52 ± 4.86	31.05 ± 5.34	3.14 ± 2.09	6.37 ± 0.81	38.93 ± 3.37
Centrosema pubescens	36.40 ± 4.56	33.39 ± 5.87	27.21 ± 1.16	3.62 ± 0.88	8.44 ± 0.22	27.34 ± 3.68
Leuceana leucocephala	28.46 ± 0.82	23.14 ± 0.91	16.14 ± 2.30	5.54 ± 0.23	7.13 ± 0.58	27.87 ± 3.82
Neptunia oleracea	19.69 ± 0.03	45.32 ± 2.13	9.52 ± 1.03	4.41 ± 0.80	7.32 ± 0.04	28.18 ± 3.08
Average	29.44 ± 1.90	30.59 ± 4.11	20.98 ± 3.04	4.18 ± 1.45	7.32 ± 0.56	30.58 ± 1.25

Table 5.6 - b : Chemical composition of legume plants

Sample/Species	DM (%)	CP (%)	CF (%)	EE (%)	Ash (%)	NFE (%)
Asystasia gangetica	15.35 ± 3.03	18.05 ± 4.20	12.95 ± 0.50	2.76 ± 0.83	16.99 ± 1.99	39.57 ± 6.28
Gynandropsis gynandra	11.79 ± 3.77	13.48 ± 2.63	15.91 ± 0.18	1.27 ± 0.60	6.90 ± 3.04	62.43 ± 1.70
Hyptis brevipes	10.54 ± 2.52	24.63 ± 7.44	11.35 ± 0.44	3.51 ± 0.62	17.58 ± 0.63	42.93 ± 7.16
Melastoma malabathricum	33.82 ± 0.82	25.33 ± 0.68	20.39 ± 0.70	1.52 ± 0.57	9.97 ± 0.23	42.78 ± 1.07
Mikania micrantha	14.14 ± 1.40	34.20 ± 9.59	20.70 ± 3.21	3.20 ± 0.69	11.20 ± 1.73	30.70 ± 5.46
Mimosa invisa	28.71 ± 0.90	23.23 ± 5.48	26.19 ± 9.52	2.51 ± 0.65	3.68 ± 0.42	44.39 ± 3.39
Average	19.06 ± 2.07	23.15 ± 5.00	17.92 ± 2.43	2.46 ± 0.66	11.05 ± 1.34	43.80 ± 4.18

Table 5.6 - c : Proximate analysis of selected weeds

In the weeds category (Table 5.6 - c), *Hyptis brevipes* showed the lowest in DM and CF contents but the highest in EE and ash contents. *Melastoma malabathricum*, which is also a shrub, has the highest DM. *Mikania micrantha* has the lowest NFE but the highest CP. CF ranged from 11.35% in *Hyptis brevipes* to 26.19% in *Mimosa invisa*. *Gnetum gnemon* shows the lowest in EE and ash but the highest NFE.

Table 5.6 - d listed three type of grasses eaten by deer in captivity. *Panicum maximum* shows a good potential forage for the deer with the highest nutrient content with respect to DM, CF and ash although the EE and NFE were on the low side. The chemical content of *Pennisetum purpureum* was not much different compared to *Panicum maximum* apart from a low CP and ash contents and slightly higher EE and NFE contents. *Brachiaria mutica* contained the lowest DM (19.48%) and CF (19.6%). It also showed a higher CP with 39.22%.

Among all the 4 legumes species in Table 5.6 - e, *Calopogonium mucunoides* showed the lowest CP, EE and ash but the highest in CF and NFE. *Leucaena leucocephala*, another legume tree, contained EE ranging from 3.14% - 5.54%. The ash content presented a small difference of between 6.37% to 8.44% in legumes. *Neptunia oleraceae*, showed the lowest DM (19.69%) and CF (9.52%). The CP level in *Neptunia oleraceae* were the highest with 45.32% compared to 20.52% in *Calopogonium mucunoides*. When *Centrosema pubescens* were compared to *Leucaena leucocephala*, there were not much differences in most of the chemical composition especially in NFE (27.34% and 27.87% respectively).

When five different plants (shrubs, trees, grass, legume and weeds) were compared (see Figure 5.1), the DM content was higher in legume than those in weeds. In general, legume contained the highest percentage of CP and EE, moderate in CF and NFE, and low in ash. Weeds on the other hand contained low EE but high in NFE. Tree has the lowest CP whereas shrubs on NFE compared to the other forage

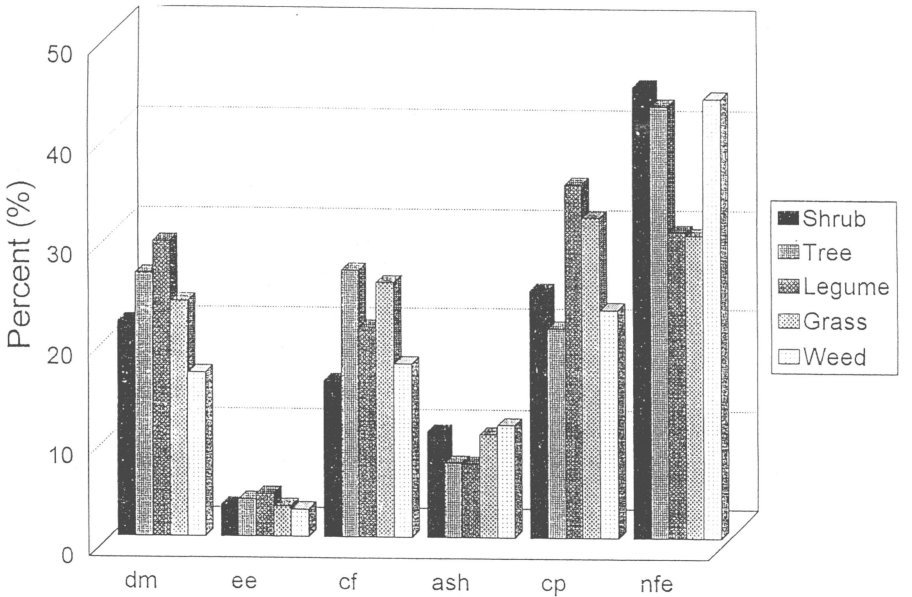
Sample/Species	DM (%)	CP (%)	CF (%)	EE (%)	Ash (%)	NFE (%)
Althernanthera triandra	14.84 ± 2.40	36.41 ± 1.71	16.81 ± 3.21	2.16 ± 0.62	14.21 ± 4.96	31.05 ± 6.29
Barringtonia racemosa	17.51 ± 0.62	22.71 ± 2.05	10.83 ± 0.98	2.03 ± 0.32	8.32 ± 0.92	55.48 ± 1.38
Dipalazium esculentum	15.34 ± 4.32	29.94 ± 5.60	6.27 ± 1.14	3.77 ± 0.89	14.22 ± 1.38	46.30 ± 5.89
Ficus hispida	25.71 ± 4.26	14.64 ± 1.84	36.27 ± 5.45	2.43 ± 0.11	16.07 ± 0.17	26.47 ± 6.00
Hibiscus rosa - sinensis	20.50 ± 0.80	39.15 ± 9.85	8.95 ± 0.37	5.01 ± 1.84	12.70 ± 0.14	33.99 ± 7.64
Homalanthus populifolius	32.29 ± 5.62	30.37 ± 8.85	15.70 ± 0.80	2.42 ± 1.43	6.79 ± 0.12	44.72 ± 3.36
Ipomoea aquatica	12.48 ± 1.34	27.63 ± 0.59	39.86 ± 0.13	3.49 ± 0.70	13.77 ± 0.31	15.25 ± 0.43
Morinda citrifolia	15.32 ± 3.11	18.23 ± 6.28	12.94 ± 0.90	3.23 ± 0.31	8.29 ± 0.19	49.32 ± 7.22
Mussaenda erythrophylla	19.79 ± 5.92	26.40 ± 0.78	16.57 ± 4.84	1.90 ± 0.63	9.50 ± 0.67	45.11 ± 3.53
Ocimum basilicum	19.19 ± 1.02	26.80 ± 3.73	7.81 ± 2.00	5.41 ± 0.15	13.11 ± 0.26	65.78 ± 3.29
Pluchea indica	20.61 ± 4.35	8.69 ± 3.49	8.86 ± 0.17	3.08 ± 0.81	9.53 ± 0.55	52.13 ± 1.32
Premna cordifolia	18.70 ± 2.27	23.42 ± 2.61	12.19 ± 0.24	3.42 ± 0.90	7.85 ± 1.21	49.74 ± 1.30
Sapium baccatum	31.24 ± 6.03	40.18 ± 6.05	22.99 ± 1.23	4.27 ± 1.43	5.20 ± 0.29	58.85 ± 5.98
Saudropus androgynus	24.46 ± 0.44	23.42 ± 2.61	9.32 ± 0.34	5.44 ± 2.33	9.74 ± 0.40	52.08 ± 2.85
Stenachlaena palustris	10.43 ± 0.16	40.18 ± 6.05	8.00 ± 4.70	1.34 ± 0.64	11.62 ± 0.09	38.86 ± 8.19
Trema orientalis	32.61 ± 0.80	14.37 ± 0.80	13.60 ± 1.89	1.85 ± 0.37	9.64 ± 0.89	60.54 ± 0.50
Average	21.46 ± 2.60	24.65 ± 3.44	15.69 ± 1.71	3.10 ± 0.83	10.62 ± 0.75	45.20 ± 3.90

Table 5.6 - d : Chemical composition of leaves from selected shrubs

Sample/Species	DM (%)	CP (%)	CF (%)	EE (%)	Ash (%)	NFE (%)
Panicum maximum	26.56 ± 8.07	31.24 ± 0.75	35.81 ± 0.88	2.75 ± 0.87	16.00 ± 1.64	15.53 ± 0.66
Pennisetum purpureum	24.30 ± 1.40	25.23 ± 3.46	21.13 ± 5.05	3.45 ± 0.84	7.54 ± 0.30	45.99 ± 4.90
Brachiaria mutica	19.48 ± 0.97	19.60 ± 0.77	39.22 ± 0.19	2.78 ± 0.34	8.93 ± 0.03	29.26 ± 0.96
Average	23.45 ± 3.36	25.36 ± 1.66	32.05 ± 2.04	2.99 ± 0.68	10.82 ± 0.66	30.26 ± 2.17

Table 5.6 - e : Proximate analysis in selected grass samples

Figure 5.1 : Average proximate analysis for various selected deer feed



class. Average PA on various forage class eaten by the deer (see Figure 5.1), indicate that shrubs can be used as suitable plants for deer feed. Weeds and tree leaves showed an average amount of nutrients which implicate the animals can eat these plants especially as a source of roughage wherever feed are scarce.

5.3.2 Fiber component

Table 5.7 a - e present data obtained from fiber digestibility analysis for neutral detergent fiber (NDF), acid detergent fiber (ADF) and lignin. Hemicellulose and cellulose contents in the plants were calculated by difference, i.e. NDF - ADF and ADF - lignin respectively.

The NDF content was highest in *Sesbania grandiflora* (59.25%) with average content around 42.95%. Tree leaves sample (n = 5) have less than the average levels of NDF and the lowest was in *Moringa oleifera* (30.89%). The ADF level ranged from 21.55% in *Dipalazium esculentum* to 45.45 % in *Homalanthus populifolius*. A wide range in cellulose digested (6.97% - 38.34%) has been observed. The average cellulose content of the plants was 2.7%.

Table 5.7 - a shows fiber contents in selected tree leaves: *Moringa oleifera* showed the lowest NDF (30.89%), ADF (16.37%) and cellulose (12.57%). The lignin content in tree leaves were as low as 2.83% in *Gnetum gnemon* and as high as 12.23 % in *Acacia mangium*. The hemicellulose ranged from 9.95% to 24.79 %. *Sesbania grandiflora* demonstrate a higher percent of cellulose (38.34%) compared to the other tree leaves species.

The fiber component of 16 selected shrubs are shown in Table 5.7 - b. NDF content ranged from with 37.11% (*Sapium baccatum*) to 69.46% (*Stenachlaena palustris*). *Dipalazium esculentum* showed the lowest ADF (21.55%), whereas *Homalanthus populifolius* had the highest level of ADF (45.45%). *Barringtonia*

racemosa showed the highest percentage of lignin (12.60%) whereas *Saudropus androgynus* had the lowest (4.42%). There was a remackably wide range in hemicellulose content in shrubs, (4.3% to 30.73%). Cellulose content was less varied. Several plants contained less than 20% cellulose including *Dipalazium esculentum*, *Trema orientalis*, *Barringtonia racemosa*. *Sapium baccatum* contained the lowest cellulose (6.97%) whereas *Homalanthus populifolius* contained the highest amount of cellulose (37.14%).

Fiber components in four legume plants are presented in Table 5.7 - c. *Calopogonium mucunoides* showed the lowest percentage of NDF, ADF, lignin and cellulose compared to *Neptunia oleraceae*, which had a higher content of ADF, lignin and hemicellulose. *Centrosema pubescens* ranked the highest in NDF and cellulose content (40.30% and 18.82% respectively) among all the legumes. *Leucaena leucocephala* contained an average amount of fiber component amongst all legumes analysed.

Table 5.7 - d shows the fiber components in grass species. *Panicum maximum* has the highest amount of lignin (12.83%) and hemicellulose (12.15%) but low in cellulose (6.58%) compared to *Pennisetum purpureum* and *Brachiaria mutica*. The percentage of NDF in grasses ranged from 35.34% in *Pennisetum purpureum* to 28.27% in *Brachiaria mutica*. *Pennisetum purpureum* demonstrated the highest in ADF and cellulose but the lowest in lignin with 3.74% compared to that in *Panicum maximum* (12.83%). Grass species with the lowest in ADF and hemicellulose contents (16.52% and 4.78%, respectively) were shown in *Brachiaria mutica*.

Table 5.7 - e presents fibre contents from six weed species. *Gynandropsis gynandra* showed the lowest amount of NDF (35.16 %), ADF (17.35%) and lignin (3.30%) whereas *Asystasia gangetica* contained a higher content of lignin (11.03 %) and hemicellulose (23.83 %) but a lower amount of cellulose. The ADF level in these weed species ranged from 17.35 % to 35.95%. *Melastoma malabathricum*

Sample/Species	NDF (%)	ADF (%)	Lignin (%)	Hemicellulose (%)	Cellulose (%)
Acacia mangium	39.48 ± 6.31	25.56 ± 2.21	12.23 ± 1.27	13.92 ± 4.32	13.33 ± 2.23
Artocarpus integra	52.01 ± 2.89	28.56 ± 8.40	10.45 ± 3.09	23.45 ± 5.20	18.11 ± 4.52
Fragraea fragrans	35.76 ± 7.12	24.91 ± 4.60	6.75 ± 2.78	10.85 ± 3.13	18.16 ± 6.22
Gnetum gnemon	35.35 ± 7.12	30.94 ± 0.28	2.83 ± 0.56	9.95 ± 0.96	28.11 ± 2.97
Moringa oleifera	30.89 ± 11.64	16.37 ± 2.38	4.54 ± 1.55	14.52 ± 3.28	12.57 ± 3.66
Pdermachera gigantia	33.15 ± 1.73	25.36 ± 2.88	11.89 ± 2.75	7.79 ± 5.33	13.47 ± 3.25
Sesbania grandiflora	59.25 ± 5.44	41.96 ± 9.33	3.62 ± 0.18	24.13 ± 6.54	38.34 ± 2.94
Solanum nigrum	57.49 ± 4.34	32.70 ± 0.22	3.32 ± 1.57	24.79 ± 7.15	29.38 ± 2.97

Table 5.7 - a : Fiber components of selected tree leaves

Sample/Species	NDF (%)	ADF (%)	Lignin (%)	Hemicellulose (%)	Cellulose (%)
Calopogonium mucunoides	27.77 ± 1.34	12.41 ± 0.85	5.42 ± 2.14	15.36 ± 3.35	3.99 ± 2.69
Centrosema pubescens	40.30 ± 5.21	25.90 ± 8.00	7.08 ± 2.03	14.40 ± 5.23	18.82 ± 2.69
Leuceana leucocephala	33.61 ± 2.97	20.41 ± 3.64	6.06 ± 0.90	12.47 ± 1.98	14.35 ± 5.33
Neptunia oleracea	34.77 ± 2.88	28.26 ± 2.16	10.27 ± 1.28	26.26 ± 7.05	17.99 ± 3.65

Table 5.7 - b : Fiber components in legume plants

Sample/Species	NDF (%)	ADF (%)	Lignin (%)	Hemicellulose (%)	Cellulose (%)
Asystasia gangetica	43.01 ± 0.70	19.18 ± 1.23	11.03 ± 3.46	23.83 ± 6.25	8.15 ± 3.22
Gynandropsis gynandra	35.16 ± 3.95	17.35 ± 1.80	3.30 ± 0.68	17.81 ± 6.94	14.05 ± 5.00
Hyptis brevipes	40.98 ± 9.71	25.15 ± 11.63	7.74 ± 2.35	18.77 ± 3.02	17.33 ± 4.08
Melastoma malabathricum	49.56 ± 7.29	28.57 ± 4.93	7.63 ± 1.47	20.99 ± 1.25	20.94 ± 5.56
Mikania micrantha	44.32 ± 3.33	29.58 ± 1.11	6.63 ± 2.35	14.74 ± 2.22	22.95 ± 8.00
Mimosa invisa	46.38 ± 2.19	35.95 ± 3.45	5.60 ± 2.25	10.43 ± 4.44	30.35 ± 9.45

Table 5.7 - c : Fiber components of selected weeds

Sample/Species	NDF (%)	ADF (%)	Lignin (%)	Hemicellulose (%)	Cellulose (%)
Althernanthera triandra	52.36 ± 10.65	28.30 ± 1.32	7.31 ± 2.78	24.06 ± 3.25	20.99 ± 4.51
Barringtonia racemosa	43.11 ± 1.26	28.18 ± 2.36	12.60 ± 0.36	14.93 ± 3.63	15.58 ± 6.25
Dipalazium esculentum	50.34 ± 2.71	21.55 ± 1.06	11.63 ± 2.38	28.79 ± 5.89	9.92 ± 2.25
Ficus hispida	55.81 ± 2.34	30.65 ± 5.08	8.11 ± 0.67	25.16 ± 3.57	22.54 ± 4.12
Hibiscus rosa - sinensis	50.55 ± 1.31	26.45 ± 9.45	4.46 ± 2.79	24.10 ± 7.45	21.99 ± 6.98
Homalanthus populifolius	49.75 ± 9.30	45.45 ± 4.84	8.31 ± 1.42	4.30 ± 0.09	37.14 ± 3.10
Ipomoea aquatica	43.83 ± 1.96	25.07 ± 3.84	4.89 ± 0.63	18.75 ± 5.42	20.19 ± 7.71
Morinda citrifolia	54.96 ± 2.37	28.85 ± 1.64	7.38 ± 1.19	26.11 ± 6.00	21.47 ± 8.65
Mussaenda erythrophylla	50.18 ± 0.08	37.96 ± 0.42	10.64 ± 3.93	12.22 ± 3.56	27.32 ± 7.01
Ocimum basilicum	40.65 ± 6.74	28.06 ± 6.09	5.94 ± 2.25	10.53 ± 4.13	22.12 ± 3.65
Pluchea indica	66.54 ± 3.42	42.15 ± 3.59	8.91 ± 3.93	24.39 ± 1.19	33.24 ± 9.08
Premna cordifolia	56.80 ± 7.09	29.58 ± 3.21	9.57 ± 2.12	11.14 ± 4.08	36.09 ± 7.79
Sapium baccatum	37.11 ± 3.25	22.04 ± 4.18	6.97 ± 1.14	14.93 ± 3.95	6.97 ± 1.14
Saudropus androgynus	52.58 ± 12.89	26.95 ± 9.14	4.42 ± 0.95	25.63 ± 4.13	22.53 ± 8.84
Stenachlaena palustris	69.46 ± 1.42	40.99 ± 3.83	9.19 ± 2.81	28.48 ± 7.02	31.08 ± 3.10
Trema orientalis	57.36 ± 4.21	26.63 ± 5.24	10.02 ± 2.36	30.73 ± 6.93	13.88 ± 1.72

Table 5.7 - d : Fiber components of leaves from selected shrubs

Sample/Species	NDF (%)	ADF (%)	Lignin (%)	Hemicellulose (%)	Cellulose (%)
Panicum maximum	31.57 ± 0.94	19.41 ± 1.14	12.83 ± 3.83	12.15 ± 3.14	6.58 ± 1.12
Pennisetum purpureum	35.34 ± 1.16	28.09 ± 2.64	3.74 ± 0.67	7.25 ± 2.09	24.35 ± 9.05
Brachiaria mutica	28.27 ± 0.71	16.52 ± 0.71	5.72 ± 1.05	4.78 ± 1.01	22.55 ± 7.54

Table 5.7 - e : Fiber components of selected grass samples

Sample/Species	NDF (%)	ADF (%)	Lignin (%)	Hemicellulose (%)	Cellulose (%)
Althernanthera triandra	52.36 ± 10.65	28.30 ± 1.32	7.31 ± 2.78	24.06 ± 3.25	20.99 ± 4.51
Barringtonia racemosa	43.11 ± 1.26	28.18 ± 2.36	12.60 ± 0.36	14.93 ± 3.63	15.58 ± 6.25
Dipalazium esculentum	50.34 ± 2.71	21.55 ± 1.06	11.63 ± 2.38	28.79 ± 5.89	9.92 ± 2.25
Ficus hispida	55.81 ± 2.34	30.65 ± 5.08	8.11 ± 0.67	25.16 ± 3.57	22.54 ± 4.12
Hibiscus rosa - sinensis	50.55 ± 1.31	26.45 ± 9.45	4.46 ± 2.79	24.10 ± 7.45	21.99 ± 6.98
Homalanthus populifolius	49.75 ± 9.30	45.45 ± 4.84	8.31 ± 1.42	4.30 ± 0.09	37.14 ± 3.10
Ipomoea aquatica	43.83 ± 1.96	25.07 ± 3.84	4.89 ± 0.63	18.75 ± 5.42	20.19 ± 7.71
Morinda citrifolia	54.96 ± 2.37	28.85 ± 1.64	7.38 ± 1.19	26.11 ± 6.00	21.47 ± 8.65
Mussaenda erythrophylla	50.18 ± 0.08	37.96 ± 0.42	10.64 ± 3.93	12.22 ± 3.56	27.32 ± 7.01
Ocimum basilicum	40.65 ± 6.74	28.06 ± 6.09	5.94 ± 2.25	10.53 ± 4.14	22.12 ± 3.65
Pluchea indica	66.54 ± 3.42	42.15 ± 3.59	8.91 ± 3.93	24.39 ± 1.19	33.24 ± 9.08
Premna cordifolia	56.80 ± 7.09	29.58 ± 3.21	9.57 ± 2.12	11.14 ± 4.08	36.09 ± 7.79
Sapium baccatum	37.11 ± 3.25	22.04 ± 4.18	6.97 ± 1.14	14.93 ± 3.95	6.97 ± 1.14
Saudropus androgynus	52.58 ± 12.89	26.95 ± 9.14	4.42 ± 0.95	25.63 ± 4.13	22.53 ± 8.84
Stenachlaena palustris	69.46 ± 1.42	40.99 ± 3.83	9.19 ± 2.81	28.48 ± 7.02	31.08 ± 3.10
Trema orientalis	57.36 ± 4.21	26.63 ± 5.24	10.02 ± 2.36	30.73 ± 6.93	13.88 ± 1.72

Table 5.7 - d : Fiber components of leaves from selected shrubs

Sample/Species	NDF (%)	ADF (%)	Lignin (%)	Hemicellulose (%)	Cellulose (%)
Panicum maximum	31.57 ± 0.94	19.41 ± 1.14	12.83 ± 3.83	12.15 ± 3.14	6.58 ± 1.12
Pennisetum purpureum	35.34 ± 1.16	28.09 ± 2.64	3.74 ± 0.67	7.25 ± 2.09	24.35 ± 9.05
Brachiaria mutica	28.27 ± 0.71	16.52 ± 0.71	5.72 ± 1.05	4.78 ± 1.01	22.55 ± 7.54

Table 5.7 - e : Fiber components of selected grass samples

showed a high level of DM with 49.56%. *Mimosa invisa* contained the highest level of ADF and cellulose (35.95% and 30.35% respectively).

5.3.3 Mineral

Minerals analysed from the plant samples were grouped into macrominerals and microminerals, are presented in Tables 5.8 and 5.9. Macrominerals normally present at level greater than 100 ppm and micromineral present less than 100 ppm (Church, 1991). .Macrominerals consists of calcium (Ca), pottasium (K), sodium (Na), phosphorus (Po) and magnesium (Mg) whereas microelements consist of cobalt (Co), copper (Cu), zink (Zn), iron (Fe), plumbum (Pb) and manganese (Mn). Aluminium (Al) which may also be considered as a toxic element (McDowell et al, 1993) was also detected

Table 5.8 presents macrominerals contents in selected browse plants. Ca level ranged from 3.85 ppm *(Ficus hispida)* to 22.95 ppm *(Dipalazium esculentum)*. Ca content was also low in *Barringtonia racemosa* and *Dipalazium esculentum* but present in ample amount in other forages. Ca content (109.45 ppm) was considerably low in *Sesbania grandiflora* (normally ~ 400 ppm) reported by other researchers (Babjee and Chin, 1991; Shelton and Jones, 1994). Phosphorus content in the plants analysed ranged from 14.84 ppm to 255.33 ppm. Phosphorus content is the lowest in *Melastoma malabathricum* (16.97 ppm), and could lead to dietary deficiency in phosphorus if this plant consist major portion in the diet.

The Ca: P ratio of the plants analysed presented a wide range, of differences from 0.2 : 1 to 15.4 : 1. A Ca : P ratio of 1:1 to 2 : 1 in the plants is usually recommended in the diet of deer and other ruminants (McDowell et al, 1993). The ratio of Ca : P is also important to ensure proper absorption of these minerals. By these standards, ratio of Ca : P in the secondary forest plants are wide, ranging from 0.16 : 1 for *Stenachlaena palustris* to 16 : 1 in *Melastoma malabathricum*. Plants with

Sample	Ca (ppm)	P (ppm)	Na (ppm)	K (ppm)	Mg (ppm)	Ca:P
Acacia mangium	130.6618 ± 4.4128	14.8449 ± 1.6965	104.8661 ± 6.3869	65.2948 ± 2.4247	21.0152 ± 1.5526	8.8 : 1
Alternanthera triandra	139.2369 ± 60.6444	90.6720 ± 8.6211	160.8826 ± 7.1627	703.1377 ± 3.3024	213.8322 ± 99.7987	1.5 : 1
Artocarpus integra	186.0062 ± 13.1923	51.5685 ± 1.4492	10.0966 ± 0.4338	148.9914 ± 14.6235	30.5449 ± 2.5850	1.5 : 1
Asystasia gangetica	165.6190 ± 10.8945	37.8899 ± 0.9896	8.9242 ± 0.0363	425.5635 ± 20.9700	116.8993 ± 14.1271	4.4 : 1
Barringtonia racemosa	23.3910 ± 0.3495	59.4993 ± 4.7493	22.8101 ± 9.2093	230.0005 ± 31.6995	40.0296 ± 5.7108	0.4 : 1
Brachiaria mutica	149.7721 ± 0.5655	53.5832 ± 0.7069	145.2213 ± 44.4691	128.2855 ± 64.3287	83.9010 ± 16.7183	2.8 : 1
Calopogonium mucunoides	202.3000 ± 23.3867	36.1934 ± 1.5551	7.9223 ± 0.0394	72.8349 ± 1.0312	45.1178 ± 7.9062	5.6 : 1
Centrosema pubescens	208.1323 ± 15.8423	29.4071 ± 0.5655	4.9050 ± 0.0682	77.1869 ± 6.3287	22.9935 ± 0.8630	7.1 : 1
Dipalazium esculentum	22.9465 ± 10.4218	129.3153 ± 8.0431	6.2601 ± 0.9598	360.9083 ± 64.9078	35.1269 ± 6.5715	0.2 : 1
Ficus hispida	385.4273 ± 27.0818	29.4041 ± 1.1341	17.2577 ± 11.2324	130.2604 ± 52.7654	56.9838 ± 9.2842	13.1 : 1
Fragraea fragrans	162.9205 ± 11.0395	31.7592 ± 2.0077	7.6747 ± 0.3304	74.3443 ± 9.0857	51.8270 ± 7.0530	5.2 : 1
Gnetum gnemon	84.6179 ± 5.8198	70.4074 ± 5.4021	12.1118 ± 0.3174	201.7154 ± 11.7854	31.0151 ± 1.5291	1.5 : 1
Gynandropsis gynandra	149.0440 ± 32.4773	149.7195 ± 2.1880	174.9525 ± 2.1880	333.4445 ± 66.3555	129.6390 ± 22.2273	1.4 : 1
Hibiscus rosa-sinensis	330.0283 ± 21.0362	92.3211 ± 21.6310	354.0735 ± 39.7865	320.1065 ± 56.8535	57.8295 ± 10.5470	3.6 : 1
Homalanthus populifolius	175.9860 ± 8.3117	27.9262 ± 1.8252	6.0208 ± 0.1516	116.6489 ±*11.3400	48.9628 ± 4.6363	6.3 : 1
Hyptis brevipes	108.0801 ± 18.2333	77.6168 ± 21.0668	16.4090 ± 6.4311	606.7370 ± 126.4032	40.3699 ± 6.9268	1.4 : 1
Ipomoea aquatica	125.1409 ± 7.2546	76.6945 ± 2.1578	1024.1205 ± 8.1147	177.3298 ± 5.6341	67.6845 ± 6.8502	1.6 : 1
Leuceana leucocephala	246.6297 ± 19.3471	56.4108 ± 0.1872	12.4161 ± 1.9039	106.4109 ± 17.0192	51.3854 ± 4.8897	4.4 : 1
Melastoma malabathricum	261.5801 ± 21.6333	16.9656 ± 1.2724	5.4841 ± 2.6330	43.3909 ± 0.4208	17.8509 ± 1.1206	15.4 : 1
Mikania micrantha	273.1110 ± 30.4510	34.9210 ± 0.4242	34.2668 ± 0.1379	174.6323 ± 23.8584	32.0887 ± 4.1056	7.8 : 1
Mimosa invisa	73.6988 ± 4.4744	44.8176 ± 0.1414	7.0357 ± 0.1215	86.7871 ± 0.1360	23.0443 ± 0.0649	1.6 : 1
Morinda citrifolia	97.6221 ± 7.9769	66.1660 ± 5.3791	546.9172 ± 3.4588	128.0091 ± 7.3294	49.5838 ± 2.8034	1.2 : 1
Moringa oleifera	194.9638 ± 11.9074	131.2854 ± 9.2461	8.5302 ± 0.7968	109.0054 ± 17.0155	47.5369 ± 2.7505	5.2 : 1
Mussaenda erythrophylla	152.8043 ± 8.5018	74.3661 ± 5.6029	18.3171 ± 6.0235	271.3075 ± 11.4725	46.6922 ± 1.9974	2.1 : 1
Neptunia oleraceae	109.5126 ± 5.8991	112.0112 ± 9.8874	107.6008 ± 8.6426	308.9974 ± 32.0436	66.4844 ± 3.8945	1 : 1
Ocimum basilicum	210.2136 ± 11.7647	169.6563 ± 0.7069	15.8439 ± 2.1439	376.0115 ± 49.7085	52.5888 ± 6.2408	1.2 : 1
Panicum maximum	24.0175 ± 1.0028	16.0325 ± 0.6334	8.0593 ± 0.3563	425.5635 ± 20.9700	116.8993 ± 14.1271	4.4 : 1
Pdermachera gigantia	51.2543 ± 4.2771	65.0350 ± 0.7069	9.4754 ± 0.1161	158.0232 ± 2.1581	36.6318 ± 5.4321	0.8 : 1
Pennisetum purpureum	49.6802 ± 2.6869	74.6589 ± 8.9545	32.5409 ± 17.2391	195.9086 ± 3.7320	21.9524 ± 0.7770	0.7 : 1
Phichea indica	144.2013 ± 14.5658	100.9450 ± 5.1332	2010.1621 ± 38.5504	162.5655 ± 10.9045	80.9469 ± 3.7069	1.3 : 1
Premna cordifolia	98.6959 ± 8.0742	78.1203 ± 0.3650	63.2916 ± 10.5885	200.0475 ± 17.4325	33.3173 ± 4.5327	1.2 : 1
Sapium baccatum	165.4698 ± 14.3836	33.2951 ± 0.4242	8.3166 ± 0.3729	50.3198 ± 4.7728	41.0576 ± 3.1402	5 : 1
Saudropus androgynus	123.2150 ± 7.6513	255.3305 ± 69.8395	21.6873± 7.7327	216.7094 ± 25.0218	185.9897 ± 18.3336	0.5 : 1
Sesbania grandiflora	109.4495 ± 11.7004	90.0710 ± 3.2672	132.2365 ± 29.6568	222.197 ± 32.2915	46.0985 ± 6.0406	1.2 : 1
Solanum nigrum	71.6652 ± 4.3369	50.2281 ± 2.3567	100.3806 ± 8.7895	164.4602 ± 14.6235	30.5449 ± 2.5850	1.5 : 1
Stenachlaena palustris	23.8353 ± 5.9298	142.0365 ± 28.9365	33.6012 ± 10.0589	432.1964 ± 44.8440	44.8986 ± 3.2410	0.2 : 1
Trema orientalis	100.3316 ± 11.7735	19.2277 ± 1.0604	8.5302 ± 0.7968	109.0054 ± 17.0155	47.5369 ± 2.7505	5.2 : 1

Table 5.8 : List of macromineral in selected plants consumed by deer

ideal Ca : P ratio were 1 : 1 (*Neptunia oleraceae and Seshania grandiflora).* Plants with relatively high Ca:P ratios are *Trema orientalis*, (4:1), *Asystasia gangetica* (5:1), *Dipalazium esculentum* (8:1) and *Leuceana leucocephala* (9:1)

Centrosema pubescens showed the smallest amount of Na with 4.09 ppm and *Pluchea indica* has the highest level with 2010.16 ppm. Low level of Na in plants is not of major concern in farmed deer since Na is normally always available in the form of salt lick.

Table 5.9 shows the amount of micromineral present in the browse plants analysed. Cu content in all plants in general were very low. The highest content was recorded in *Hibiscus rosa - sinensis* (2.06 ppm) and the lowest was detected in *Ipomoea aquatica* (0.0014 ppm), *Leuceana leucocephala* (1.0926 ppm) and *Sapium baccatum* (1.0214 ppm). Cu is known to cause toxicity when consume in excess, especially plant containing more than 20 ppm. It appears that browse plants analysed do not pose threat with respect to excess dietary Cu.

Co is a mineral with the least amount detected in the plants analysed. The amount detected ranges from 0.001 ppm to 0.03 ppm in *Barringtonia racemosa* and *Hyptis brevipes* respectively.

The Fe level in the plants analysed ranged from 0.51 ppm to 24.16 ppm with majority (n = 35) exhibited Fe content less than 8 ppm. Both *Gynandropsis gynandra* and *Ipomoea aquatica* contained quite high level of Fe (20.97 ppm and 24.1653 ppm).

Ipomoea aquatica demonstrated the highest amount of Zn (30.75 ppm) whereas *Brachiaria mutica* had the lowest (0.06 ppm). Manganese content in the plants ranged from 0.1865 ppm to 33.6012 ppm. Most of the plants have less than 10 ppm of Mn except for *Saudropus androgynus* (12.5418 ppm) and *Trema orientalis*

Sample	Co (ppm)	Pb (ppm)	Fe (ppm)	Zn (ppm)	Cu(ppm)	Mn (ppm)	Al (ppm)
Acacia mangium	0.0070 ± 0.0039	0.3553 ± 0.0532	0.6992 ± 0.0158	0.5342 ± 0.0245	0.3313 ± 0.0079	0.4074 ± 0.0057	0.8524 ± 0.0074
Alternanthera triandra	0.0228 ± 0.0002	0.4261 ± 0.0680	5.7952 ± 0.1762	4.0493 ± 0.2329	0.5334 ± 0.2669	5.5758 ± 0.2697	8.5391 ± 2.7273
Arthocarpus integra	0.0059 ± 0.0031	0.3673 ± 0.0335	1.2367 ± 0.0251	0.2222 ± 0.0301	0.2168 ± 0.0421	1.3445 ± 0.0623	0.8660 ± 0.0270
Asystasia gangetica	0.0067 ± 0.0003	0.4503 ± 0.0180	7.1745 ± 0.2127	0.2366 ± 0.0263	0.1747 ± 0.0073	0.3081 ± 0.0078	4.6989 ± 0.1786
Barringtonia racemosa	0.0010 ± 0.0001	0.1837 ± 0.0501	0.5191 ± 0.2786	0.2973 ± 0.3466	0.2574 ± 0.0074	1.7726 ± 0.1774	0.6216 ± 0.0681
Brachiaria mutica	0.0025 ± 0.0014	0.2199 ± 0.0271	1.0960 ± 0.0319	0.0649 ± 0.0239	0.1499 ± 0.0239	0.4483 ± 0.0278	0.5217 ± 0.0918
Calopogonium mucunoides	0.0029 ± 0.0003	0.3539 ± 0.0785	5.6916 ± 0.1179	0.2070 ± 0.0350	0.2282 ± 0.0116	0.3391 ± 0.0120	1.1764 ± 0.0989
Centrosema pubescens	0.0077 ± 0.0048	0.2779 ± 0.0309	1.7291 ± 0.0435	0.2161± 0.0350	0.2282 ± 0.0116	0.3391 ± 0.0120	1.1764 ± 0.0989
Dipalazium esculentum	0.0029 ± 0.0027	0.2393 ± 0.0670	1.3884 ± 0.0348	0.7074 ± 0.0517	0.3586 ± 0.0209	0.4204 ± 0.0437	0.7464 ± 0.0521
Ficus hispida	0.0049 ± 0.0009	0.1957 ± 0.1131	4.6645 ± 0.0449	0.2664 ± 0.0284	0.7967 ± 0.0844	0.3651 ± 0.0166	3.5808 ± 0.0927
Fragraea fragrans	0.0041 ± 0.0020	0.3673 ± 0.0335	4.3178 ± 0.2271	0.7225 ± 0.3373	0.2714 ± 0.0114	2.2567 ± 0.0074	3.4556 ± 0.0860
Gnetum gnemon	0.0068 ± 0.0041	0.3539 ± 0.0784	1.0365 ± 0.0400	0.7706 ± 0.0606	0.5968 ± 0.0299	3.6112 ± 0.1542	2.1774 ± 0.1111
Gynandropsis gynandra	0.0191 ± 0.0016	0.5188 ± 0.1617	20.9728 ± 0.1767	0.3293 ± 0.0247	0.1827 ± 0.0096	1.5893 ± 0.1738	30.0927 ± 2.6118
Hibiscus rosa - sinensis	0.0019 ± 0.0010	0.1306 ± 0.0071	0.6389 ± 0.0334	1.5271 ± 0.0830	2.0674 ± 0.0074	0.2876 ± 0.0126	0.7899 ± 0.0672
Homalanthus populifolius	0.0123 ± 0.0020	0.3341 ± 0.0334	1.8607 ± 0.2637	0.1386 ± 0.0346	0.1337 ± 0.0013	7.7314 ± 0.0958	2.7951 ± 0.04785
Hyptis brevipes	0.0330 ± 0.0004	0.1328 ± 0.0502	1.5066 ± 0.0435	0.8568 ± 0.0672	0.4050 ± 0.1950	7.4353 ± 0.8302	3.1985 ± 0.4410
Ipomoea aquatica	0.0049 ± 0.0005	12.3500 ± 0.7962	24.1653 ± 0.0532	30.750 ± 7.6372	0.0014 ± 0.0007	1.3303 ± 0.0053	4.6606 ± 0.7472
Leuceana leucocephala	0.0019 ± 0.0010	0.1152 ± 0.0226	1.2828 ± 0.0562	0.4998 ± 0.0534	1.0926 ± 0.0882	0.2763 ± 0.0102	0.9512 ± 0.0900
Melastoma malabathricum	0.0048 ± 0.0014	0.1488 ± 0.0243	1.0262 ± 0.0399	0.1100 ± 0.0206	0.1476 ± 0.0081	0.6507 ± 0.2225	0.3749 ± 0.0407
Mikania micrantha	0.0046 ± 0.0011	0.2896 ± 0.1775	1.5083 ± 0.0634	0.9859 ± 0.0656	0.3432 ± 0.0146	0.5022 ± 0.0399	0.8190 ± 0.0471
Mimosa invisa	0.0048 ± 0.0014	0.1488 ± 0.0243	1.0262 ± 0.0399	0.1100 ± 0.0206	0.1476 ± 0.0081	0.6507 ± 0.2225	0.3749 ± 0.0407
Morinda citrifolia	0.0105 ± 0.0004	0.4399 ± 0.0543	2.3593 ± 0.0963	0.8853 ± 0.0790	0.2478 ± 0.0162	1.1206 ± 0.0570	1.8553 ± 0.1436
Moringa oleifera	0.0045 ± 0.0016	0.2384 ± 0.1165	0.5378 ± 0.1559	0.3360 ± 0.1842	0.1465 ± 0.0023	0.1865 ± 0.0044	0.7855 ± 0.0473
Mussaenda erythrophylla	0.0048 ± 0.0021	0.2320 ± 0.0159	1.5453 ± 0.0576	0.8564 ± 0.0699	0.9778 ± 0.2652	0.5529 ± 0.0521	2.5516 ± 0.1181
Neptunia oleraceae	0.0165 ± 0.0018	0.3554 ± 0.0768	6.2054 ± 0.1764	0.8880 ± 0.0677	0.4356 ± 0.1278	5.8730 ± 0.2727	1.7379 ± 0.1238
Ocimum basilicum	0.0068 ± 0.0041	0.2679 ± 0.1027	1.3444 ± 0.0150	1.4108 ± 0.0205	0.7707 ± 0.0116	0.9961 ± 0.0826	2.8233 ± 0.0152
Panicum maximum	0.0076 ± 0.0002	0.1922 ± 0.1476	2.9042 ± 0.0829	1.8098 ± 0.1444	0.0715 ± 0.0063	1.6643 ± 0.2602	0.5159 ± 0.1238
Pennisetum purpureum	0.0049 ± 0.0011	0.1510 ± 0.0096	2.4068 ± 0.0266	0.5726 ± 0.0266	0.5615 ± 0.1610	0.6355 ± 0.0437	1.8546 ± 0.0411
Pdermachera gigantia	0.0038 ± 0.0009	0.1168 ± 0.0067	1.7634 ± 0.0515	0.0881 ± 0.0215	0.1619 ± 0.0061	4.2223 ± 0.4052	0.9740 ± 0.0537
Pluchea indica	0.0256 ± 0.0044	0.2696 ± 0.1319	0.7491 ± 0.0339	0.9600 ± 0.0630	0.4900 ± 0.1600	2.6195 ± 0.1110	1.1587 ± 0.4391
Premna cordifolia	0.0041 ± 0.0021	0.2672 ± 0.0468	1.2799 ± 0.2693	0.5961 ± 0.3404	0.1615 ± 0.0002	0.6246 ± 0.0455	1.0812 ± 0.0587
Sapium baccatum	0.0059 ± 0.0026	0.3281 ± 0.0425	0.7655 ± 0.0427	0.5826 ± 0.0427	1.0214 ± 0.1185	1.1426 ± 0.1371	0.9641 ± 0.2162
Saudropus androgynus	0.0224 ± 0.0003	0.7116 ± 0.0322	0.8529 ± 0.0407	5.0653 ± 0.1746	0.8960 ± 0.0774	12.5418 ± 1.2522	0.9965 ± 0.0312
Sesbania grandiflora	0.0108 ± 0.0043	0.3853 ± 0.1089	3.8564 ± 0.1673	0.3714 ± 0.044	0.8960 ± 0.0774	1.2560 ± 0.1576	0.7405 ± 0.0933
Solanum nigrum	0.0062 ± 0.0013	0.3093 ± 0.0614	6.0944 ± 0.1197	0.4071 ± 0.0473	0.5572 ± 0.0322	0.8745 ± 0.0294	8.6446 ± 0.6764
Stenachlaena palustris	0.0049 ± 0.0040	0.2199 ± 0.0271	0.9198 ± 0.0284	0.8735 ± 0.0686	1.6029 ± 0.1353	33.6012 ± 1.0589	1.2738 ± 0.0715
Trema orientalis	0.0064 ± 0.0030	0.3162 ± 0.1129	3.9183 ± 0.0584	0.8706 ± 0.0191	0.0976 ± 0.0034	10.1197 ± 0.8396	2.2812 ± 0.0656

Table 5.9 List of microminerals in selected plants consumed by deer

(10.1197 ppm).

The highest plant content of Al was shown in *Gynandropsis gynandra* (30.0927 ppm), which was nearly 4 times higher than that detected in *Althernanthera triandra* (8.5391 ppm). Several other plants has Al level lower than 4 ppm, i e *Asystasia gangetica* and *Ipomoea aquatica*. *Melastoma malabathricum* contained the lowest Al (0.37 ppm).

As a whole, mineral contents in *Ipomoea aquatica*, when compared to other plants are on the higher side with respect to Pb (12 ppm), Fe (24 ppm) and Zn (30 ppm). It is worth noting that Cu content in *Ipomoea aquatica* was very low (0.001 ppm).

Mineral analysis has shown that most browse plants appeared to contain adequate amount of Ca, Zn, Fe, K and Mg whereas Cu, Na, and P level were on low Nutrient level (Table 5.8 and Table 5.9) were generally similar to those reported elsewhere (McDowell et al. 1993) for other plant species apparent differences may be attributed to variation in soil type and plant maturity. There is very little information available on mineral content in shrubs and tree for comparisons except for several outstanding plants such as *Leucaena leucocephala* (Gutteridge and Rekib, 1994) and *Sesbania grandiflora* (Shelton and Jones, 1994).

5.3.4 Metabolizable energy

Metabolizable energy (ME) values of feedingstuff are essential for formulating livestock rations in order to fulfill the specific energy requirements for growth, reproduction and production. The methods used for determining ME were adopted from procedures described by Menke et al. (1979). ME for 9 selected browse plants from 3 collections (I, II, III) were determined within the same year (1994).

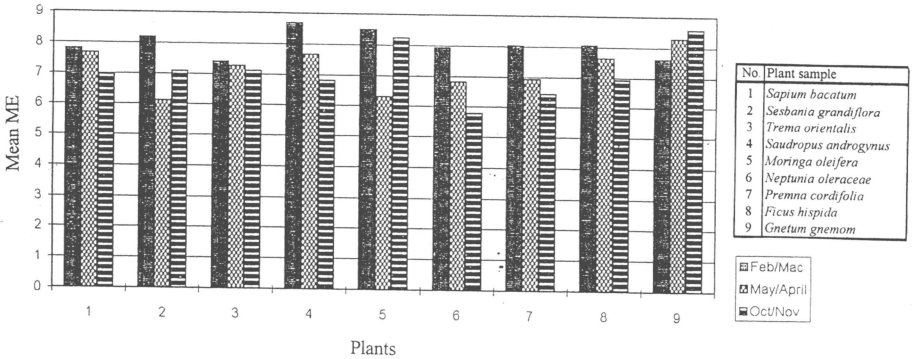


Figure 5.2 : Mean Metabolizable Energy (kJ/kg) in selected plants

Figure 5.2 shows the mean ME in 9 selected browse plants from 3 different times of the year. In Feb/Mac, *Saudropus androgynus* , *Moringa oleifera, Premna cordifolia* and *Ficus hispida* contained more than 8.00 kJ/kg DM of ME, while the other plants had less than 7.00 kJ/kg DM. *Gnetum gnemon* had the highest ME in April/May ranging from 6.10 kJ/kg to 7.60 kJ/kg DM. *Neptunia oleraceae* on the other hand contained the lowest ME (5.75 kJ/kg DM) when compared to plant sampled in Feb/Mac (7.91 kJ/kg DM) and in April/May (6.81 kJ/kg DM). There was also a decrease flow in *Saudropus androgynus* and *Ficus hispida*.

The ME content in *Trema orientalis* was more consistent throughout the year. There was an upward trend in *Gnetum gnemon* ME content from Feb/Mac to Oct/Nov (7.61 kJ/kg DM – 8.57 kJ/kg DM). The ME content of *Moringa oleifera* was lowest in April/May (6.35 kJ/kg DM) when compared to Feb/Mac (8.50 kJ/kg DM) and Oct/Nov (8.23 kJ/kg DM) values. Similar trends apply to *Sesbania grandiflora*. ME content in *Premna cordifolia* demonstrated a sharp fall from Feb/Mac (8.03 kJ/kg DM) to April/May (6.91 kJ/kg DM) which decreased further albeit slightly in Oct/Nov (6.44 kJ/kg DM).

An overall assesment of the mean value of ME of the plant analysed for the whole year indicate that *Gnetum gnemon* contained the highest ME content (8.48 kJ/kg DM) whereas *Neptunia oleraceae* (6.59 kJ/kg DM) contained the lowest ME.

5.3.5 Anti - nutritional value

Table 5.10 shows the presence of saponin, alkaloid and terpenoid using TLC method. Alkaloid was absent in *Asystasia gangetica, Gnetum gnemon, Gynandropsis gynandra, Stenachlaena palustris, Saudropus androgynus, Leuceana leucocephala, Ipomoea aquatica, Trema orientalis* and *Fragreae fragrans*. Other plants showed evidence of the existence of alkaloid from all extraction solvents.

Sample	Saponin			Terpenoid			Alkaloid		
	Pet. E	$CHCl_3$	MeOH	Pet. E	$CHCl_3$	MeOH	Pet. E	$CHCl_3$	MeOH
Grass									
Brachiaria mutica	+	-	-	+	-	+	+	+	+
Panicum maximum	-	+	+	-	+	-	+	+	+
Pennisetum purpureum	-	-	-	-	-	-	+	+	+
Legume									
Calopogonium mucunoides	+	-	-	+	-	-	+	+	+
Centrosema pubescens	-	-	-	+	-	-	+	+	+
Leuceana leucocephala	+	+	+	-	+	+	-	-	-
Neptunia oleraceae	-	-	+	-	-	+	+	+	+
Shrub									
Althernanthera triandra	-	+	+	-	+	+	+	+	+
Barringtonia racemosa	-	+	+	-	+	-	+	+	+
Dipalazium esculentum	-	-	-	+	-	+	+	+	+
Ficus hispida	-	-	+	+	-	-	+	+	+
Hibiscus rosa - sinensis	-	+	+	-	+	+	+	+	+
Ipomoea aquatica	-	+	+	-	+	-	-	-	-
Morinda citrifolia	+	+	+	+	+	-	+	+	+
Mussaenda erythrophylla	-	+	-	+	+	-	+	+	+
Ocimum basilicum	+	+	+	+	+	+	+	+	+
Pluchea indica	+	+	+	+	-	-	+	+	+
Premna cordifolia	-	+	+	-	+	+	+	+	+
Sapium baccatum	+	+	+	-	-	+	+	+	+
Saudropus androgynus	+	+	+	+	-	-	-	-	-
Stenachlaena palustris	+	+	+	+	-	+	-	-	-
Trema orientalis	-	+	-	+	-	-	-	-	-
Tree									
Acacia mangium	+	+	+	+	+	+	+	+	+
Artocarpus integra	-	+	-	+	+	+	+	+	+
Fragreae fragrans	+	-	+	+	+	+	-	-	-
Gnetum gnemon	+	+	+	+	-	+	-	-	-
Moringa oleifera	-	+	+	-	+	+	+	+	+
Pdermachera gigantia	+	+	+	+	+	+	+	+	+
Sesbania grandiflora	-	+	+	-	+	+	+	+	+
Solanum nigrum	-	-	+	-	-	+	+	+	+
Weed									
Asystasia gangetica	+	+	+	+	+	-	+	+	+
Gynandropsis gynandra	-	-	-	+	-	+	+	+	+
Hyptis brevipes	+	+	+	+	-	+	+	+	+
Melastoma malabathricum	+	+	-	-	+	-	+	+	+
Mikania micrantha	+	-	-	-	-	+	+	+	+
Mimosa invisa	+	-	-	-	-	-	+	+	+

Table 5.10 : Presence of anti nutritional factors (saponin, terpenoid, alkaloid) in plant samples

There were no evidence of the presence of saponin in *Dipalazium esculentum*, *Gynandropsis gynandra* and most of the legume; *Calopogonium mucunoides* and *Centrosema pubescens*. *Pdermachera gigantia* has more saponin in petroleum ether and chloroform extraction than the rest but the amount was less when the plants sample was shaken in methanol. *Stenachlaena palustris* and *Ocimum basilicum* had a moderate content of saponin in all extraction solvents.

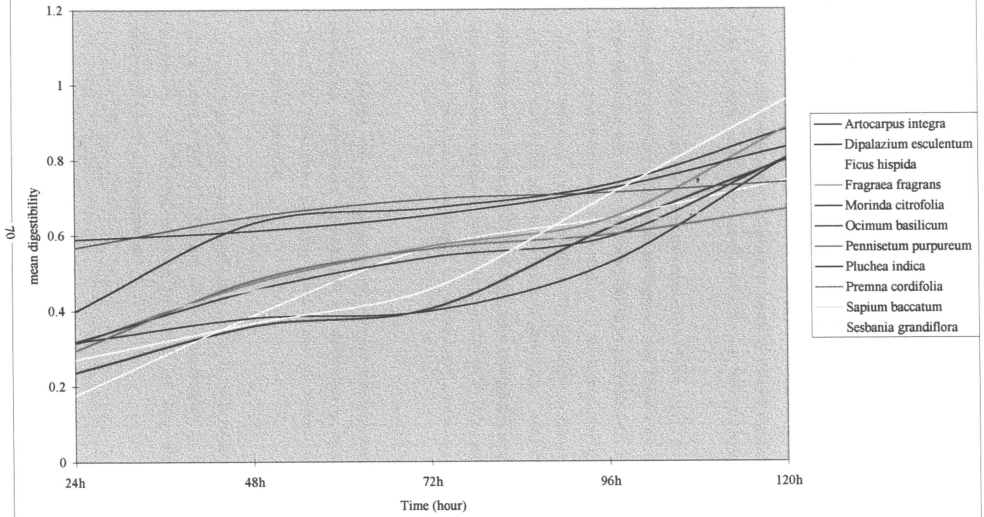
Terpenoid was not detected in *Homalanthus populifolius*, *Pennisetum purpureum* and *Mimosa invisa*. However, it was shown to be present in *Acacia mangium*, *Artocarpus integra*, *Fragreae fragrans*, *Ocimum basilicum* and *Pdermachera gigantia*

5.3.6 Rusitec fermentation system

Figure 5.3 illustrates the extent of DM digestion (%) by the rumen mixture during anaerobic fermentation for 11 selected plants. Only two plants, *Pluchea indica* and *Pennisetum purpureum* achieved DM greater than 50 % after 24 h incubation whereas *Artocarpus integra* had 60 % DM digestibility after 48 h incubation *Fragreae fragrans*, *Ficus hispida*, *Premna cordifolia* and *Sapium baccatum* had low DM digestibility throughout the course of incubation and achieved between 55 % - 85 % DM digestibility after 120h incubation. *Sesbania grandiflora*, *Dipalazium esculentum* dan *Morinda citrofolia* had much lower DM digestibility than those in group above. However an increase in DM digestibilities took place after 72 h of incubation i.e. from a mean of 0.30 to 0.90. All other plants showed gradual increase in DM digestibility with time front = 24 h.

The rates of DM disappearance however was different between plants..*Sesbania grandiflora* had the fastest rate of DM disapperance from 72 h to 120 h compared to *Sapium baccatum* which also showed a sharp growth but not as high as *Sesbania grandiflora*. *Ficus hispida*, *Artocarpus integra* and *Prema cordifolia*

Figure 5.3 : Dry matter digestibility of selected browse plants in RUSITEC fermentation system



demonstrate an increase from 24 h to 48 h but moderate growth to 120 h. Even though *Ficus hispida* were the lowest in 24 h but it starts to a sharp increment to 72 h.

5.4 Statistical analysis

The analysis of variance or PA for *Sapium baccatum* were shown in Appendix H. The effect of location of *Sapium sp.* sampling showed significance ($P < 0.01$) for DM, CF, NFE and ADF, but not ($P > 0.05$) for Ash, NDF and lignin.

ANOVA on the chemicals composition (Table 5.11) for each of the plant: *Sesbania grandiflora, Saudropus androgynus* and *Premna cordifolia* (when leaves were compared with shoots and twigs) was shown in Table 5.11. Eight duplicates for *Sesbania grandiflora* and 11 duplicates of *Saudropus androgynus* and *Premna cordifolia* were used in each treatments. No significant difference ($P > 0.05$) in CP, ash, NFE and lignin content in *Sesbania grandiflora* were found whereas the differences in CF, EE, ash, NDF and ADF were highly significant ($P < 0.01$). There was significant variation ($P < 0.01$) in DM, CP, NDF, ADF and lignin in *Premna cordifolia*. Difference in variation in CF, ash and NFE content was not significant ($P > 0.05$).

ANOVA was also carried out to compare nutrient contents in leaves and shoots from three plants; i.e. *Leuceana sp., Artocarpus sp.* and *Moringa sp.* (see Table 5.11). These plants are highly palatable and will be consumed readily by rusa deer (*Cervus timorensis*).

Moringa oleifera varies significantly ($P < 0.01$) with respect to CF and lignin content, whereas DM, CF, EE and ash were significantly ($P < 0.01$) varied in *Leuceana sp.*. Out of nine replicates, DM, ADF and lignin showed significantly variation ($P < 0.01$) in *Artocarpus sp.*

sample	df			F-value								
leaves/shoots/twigs	model	error	total	DM	CP	CF	EE	Ash	NFE	NDF	ADF	Lignin
Premna cordifolia	2	9	11	46.22**	21.63**	1.83**	7.10*	2.34ns	1.92ns	206.80**	75.79**	36.86**
Saudropus androgynus	2	9	11	2.97ns	1.39ns	8.66**	7.66**	11.73**	2.41ns	48.28**	29.85**	6.53*
Sesbania grandiflora	2	6	8	6.96*	1.02ns	15.37*	197.41**	1.67ns	4.85ns	6.31*	21.49*	2.68ns
Leaves/shoots												
Artocarpus integra	1	9	10	7.65**	2.03ns	3.00ns	10.69*	3.47ns	7.81*	2.02ns	23.25**	30.95**
Leuceana leucocephala	1	8	9	30.56**	6.57*	23.10**	18.41**	61.04**	4.84ns	11.50**	3.46ns	4.53ns
Moringa oleifera	1	6	7	2.09ns	9.06*	626.65**	13.71*	1.86ns	12.53*	0.00ns	1.27ns	36.19**
Leaves/twigs												
Althernanthera triandra	1	6	7	18.97**	67.25**	25.82**	17.42**	2.88ns	4.05ns	9.75*	0.16ns	5.46ns
Dipalazium esculentum	1	7	8	8.22*	1.82ns	6.23*	10.33*	1.76ns	13.82**	1.57ns	1.86ns	18.07**
Gnetum gnemon	1	6	7	1.34ns	2.12ns	33.47**	0.08ns	0.28ns	7.91*	11.86*	0.05ns	0.89ns
Pdermachera gigantia	1	12	13	6.79*	11.55**	33.53**	0.72ns	10.33**	13.25**	4.45ns	0.00ns	108.47**
Solanum nigrum	1	6	7	16.51**	2.23ns	0.24ns	12.99**	4.82ns	3.09ns	4.81ns	0.22ns	0.58ns

Table 5.11 : Analysis of variance of nutrient composition on different parts of selected browse plants

Comparison for leaves to twigs were done among five plants shows that *Gnetum gnemon* was only significant in CF. While *Solanum nigrum* was highly significant in DM and EE and *Dipalazium esculentum* was significant in NFE and lignin. DM, CP, CF and EE were significantly effected in *Alternanthera triandra* and *Pdermachera gig*antia were significantly difference in CP, CF, ash, NFE and lignin.

From the analysis of variance (ANOVA) at $P < 0.01$ (see Table 5.11), there was no significant difference in the preference of eating for all treatments. In the multiple range test ($P- < 0.05$), there was significant difference in parts between treatment.