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DIFFERENT TYPES OF MAIZE SILAGE AND UNCONVENTIONAL FEED RESOURCES AND THEIR NUTRITIVE VALUES

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SUMMARY

This research was conducted for one year at Chittagong Veterinary and Animal Sciences (CVASU) Fodder Research Field and at the Animal Nutrition Laboratory to produce maize fodder and silage and evaluate them and estimate the nutritive value of unconventional feed resources. The maize fodder was cultivated under four different treatment groups. It was observed that the green fodder biomass, dry matter and botanical fractions of maize were dependents on the dose level of sheep and goat manure with inorganic fertilizers. The treatment receiving sheep and goat manure @ 10 t/ha produced higher green fodder yield (30.30±.07 t/ha) and dry matter (9.0±0.28 t/ha) than the other treatments. Three types of silage were prepared in bag and drum. The bag silage was spoiled due to unsystematic preparation method. However, the drum silage, the silage 3 (maize with molasses and urea) showed highest pH (4.69), crude protein (CP) (10.50%), ether extract (EE) (4.05%), nitrogen free extract (NFE) (41.63%) and metabolisable energy (ME) (1992 kcal/kg) than other silage. All three types of drum silage were good but consideration of pH and nutrients composition the silage prepared with maize fodder with molasses was good than others. Different unconventional feed, such as tree leaves, seeds and byproduct were collected and analyzed for their nutritive values. It was noticed that the dry matter was highest in Krisnachura (34%), CP and energy in Dhaincha (26% and 2594.44 kcal/kg), NFE in water hyacinth than other tree leaves. The rain tree seed was higher in DM (88.6%), CP (28.5%) , EE (10.5%) and energy (2794 kcal) than other feeds. Rubber seed contained nutrient composition close to rain tree seed but husk contained highest CF (48.5%) than other seeds. All studied tree leaves, seeds and byproduct can be used as alternative feed resources for livestock. Furthermore, Dhaincha, ipil-ipil, rain tree and rubber seed could be used as livestock and poultry feed ingredient due to its high protein and energy value.

Key words : Maize fodder, silage, nutritive value, unconventional feed ingredients

Maize fodder is good for all types of animals. Green maize forage is rich in vitamin-A, and contains 1.56 per cent protein, 0.30 per cent fat and 5.27 per cent fiber (Chaudhry, 1982). To boost the fodder maize production, it is necessary to adapt proper production technology. Preservation of surplus fodder by silage making when fodder is abundant can help to reduce its irregular supply pattern round the year. Manipulating this surplus fodder can bridge the gap between supply and demand during scarcity periods. The performance of dairy animals depends on the consistent availability of quality fodder in adequate amount. Therefore, the critical limitation on profitable animal production in developing countries is the inadequacy of quality forage (Sarwar *et al*., 2002). In many developing countries because of ever growing human need for food, only limited cultivated land used for fodder yield and fodder scarcity periods, one is during summer months and second in the winter months, further aggravated the situation (Sarwar *et al*., 2002). In rest of the year, fodder is abundantly available and remains intact in the fields. When feed is available it is required to preserve into proper way in optimum nutrient condition.

Moreover, in commercial dairying, feed cost alone accounts for 60-70 per cent of total production cost (Bulbul and Hossain, 1989). Therefore, this is a demand of time to explore locally available cheaper alternative feed resources to reduce feed cost. Cattle

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have been fed various crop residues and unconventional feedstuffs for years. Proper utilization of unconventional feeds by ruminants will not only benefit the animal industry but will increase the economic returns of many cash crops. Tree leaves, seeds and byproducts have a good potential for use of ruminant and non-ruminant rations so that the gap between the demand and supply of feeds and fodders can be shortened. Efforts are focused on determining the seasonal availability and nutritive value of locally available leaves, seed and by-products with a view to formulate adequate year round feeding system. Therefore, the present study was undertaken with the objectives : (i) to produce maize fodder with sheep and goat manure and identify the suitable dose of this manure with inorganic fertilizer for optimum maize fodder production, (ii) to prepare the different silage using molasses, urea and evaluate the silage, and (iii) to estimate the nutritive values of different maize silage and unconventional feed resources suitable to use in ruminant ration.

MATERIALS AND METHODS

The research work was conducted at the fodder research field of Chittagong Veterinary and Animal Sciences University (CVASU) and the Animal Nutrition Laboratory of CVASU from July 2010 to June 2011.

Production of Maize Fodder

Maize fodder was cultivated during February 2011 to April 2011 at CVASU fodder research field. There were four different treatment groups (T_1 : T_2 : T_3 : T_4) which were applied with different doses of sheep and goat manure. T_1 contained standard dose of chemical fertilizer without sheep and goat manure, T_2 contained standard dose of chemical fertilizer and 5 t/ha sheep and goat manure, T_3 contained standard dose of chemical fertilizer and 10 t/ha sheep and goat manure and T_4 contained standard dose of chemical fertilizer and 15 t/ha sheep and goat manure.

Composite soil samples were taken to a depth of 20 cm at the start of the study and were sent to Regional Soil Research Centre at Hathazary, Chittagong for laboratory analysis before manure application. Raw sheep and goat manure was collected from CVASU Animal Shed. After collection of raw faeces these were preserved for 15 days in underground for processing and fermentation. In this period, manure was considered by farmers to be ready for utilization as fertilizer for crop production. The crop hybrid maize (*Zea mays*) was sown on 10 February 2010 using seed rate of 30 kg/ha in 70 cm apart rows and 30 cm intra-row with the help of a single row drill and harvested in April 2010.

Preparation of Maize Silage

Two silo (bag silo and drum silo) were used for preparation of silage. In bag silo, about 50 kg maize fodder was ensiled plastic bag and compacted by hand, to exclude as much air as possible, and then tied by a string to ensure air tightness. For drum silo, three types of silage were made from maize grass. Three types of silage were prepared using with or without additives as the following composition.

Silage 1 was prepared only using maize fodder. Silage 2 was prepared using molasses with fodder. After chopping of maize 4 per cent molasses were mixed with grasses then filled silo pit and prepared silage and silage 3 was prepared using molasses and urea with fodder. After chopping of maize 4 per cent molasses and 2 per cent urea were mixed with grasses then filled silo pit and prepared silage.

In both the cases maize was harvested at 70 days of age. The grass contained about 30-35 per cent dry matter at the time of ensiling. The maize was then chopped into small pieces. Chopping was made easy to compact the silage and to remove the air. Then the small piece of maize was filled into the bag and the container (drum) layer by layer. Compacted the crop all the time by continuous treading. This removed the air from inside the silo. The drum was sealed quickly which speeded up the fermentation process. The bag and drum were left to incubate in room temperature for 2-3 months.

Estimation of Nutritive Value of Unconventional Dairy Feed

Different unconventional feeds such as tree leaves (Krisnachura, Ipil-Ipil, Neem, Kanchan, Rain tree, Mahogany, Korai, Water hyacynth, Bamboo, Jackfruit, Christmas and Dhaincha) and seeds (Rubber seed, rain tree seed, gram husk, pea and wheat bran) and byproduct were collected from different locations of Chittagong and analyzed their nutritive value from Animal Nutrition and Poultry Research and Training Institute (PRTC) laboratory at CVASU.

Sample Collection and Preparation for Chemical Analysis

In case of maize, fodder was collected from different locations of plot after final cutting and chopped (1-2 cm) the sample and mixed well and 500-1000 g fodder was taken for chemical analysis. The sample was dried into the sunlight for about 2-3 days and milled and grinded using grinder and filled in polythene bag and levelled the sample for chemical analysis.

In case of silage, the silo pit was opened after three months of preparation of silage. The silage sample was taken randomly from different parts of silo pit and mixed homogenously and 100-200 g sub-sample was then taken and dried into sun. The sub-sample was melt and dried and filled into air tight container for chemical analysis. However, the pH and DM were estimated from the fresh sample.

In case of unconventional feed, the leaves and seeds samples were collected from different trees and under the trees and from market. Then the leaves are separated and dust was removed from the leaves and seed. The samples were air-dried and grinded separately and stored in air tight container for proximate analysis.

Analysis of Sample

Chemical analyses of the maize fodder samples, silage samples and all unconventional feed samples were carried out in triplicate for moisture, dry matter (DM), crude protein (CP), crude fibre (CF), nitrogen free extracts (NFE), ether extracts (EE) and ash in the Animal Nutrition Laboratory and PRTC Laboratory in CVASU, Bangladesh as per AOAC (2000).

Calculation of Metabolizable Energy (ME)

ME was calculated separately for all unconventional feed samples. Calculation was performed by mathematical formula as per Lodhi *et al.* (1976).

Statistical Analyses

The data on fodder growth, botanical fraction and chemical composition of fodder were recorded after final cutting during 70 days of plantation and analyzed using Proc GLM and Proc MIXED of SAS (SAS, 2000) in considering completely randomized design. Treatment means were compared by using the least significant difference (LSD) test at P>0.0 5 level (Steel *et al.,* 1997). In case of nutritive value of silage and unconventional feed, all data were collected from laboratory analysis and average values were calculated using Microsoft Excel 2007.

RESULTS AND DISCUSSION

Botanical Fraction of Maize

Plant height enhanced final yield of fodder crops. Mean values (Table 1) regarding plant height indicated that different organic fertilizers affected the plant height significantly. All the treatments applied with sheep and goat manure produced significantly taller plants as compared to control. Treatment receiving sheep and goat manure (@ 10 t/ha) produced the tallest plants (188.50 cm) followed by T_2, T_1 and T_0 treatments. But there was no significant difference found between the T_2 and T_3 treatments and T_1 and T_3 treatments. The minimum

TABLE 1
Effect of different doses of sheep and goat manure on botanical fraction and yield of maize fodder (Mean with standard deviation)

Parameter	Treatments			
	T_1	T_2	T_3	T_4
Plant length (cm)	128.13^{a}±16.62	162.50^{b}±2.12	188.50^{c}±2.12	181.00^{bc}±5.66
Stem length (cm)	67.50^{a}±3.54	98.50^{b}±4.94	132.00^{d}±15.56	119.50^{bc}±13.44
Leaf/plant	8.50^{a}±0.707	11.50^{b}±0.707	13.50^{c}±0.707	12.50^{c}±0.707
Biomass yield (t/ha)	14.90^{a}±0.505	24.05^{b}±0.636	30.50^{d}±0.071	29.00^{c}±0.707
Dry matter yield (t/ha)	3.95^{a}±0.071	6.60^{b}±00	9.00^{c}±0.282	8.50^{c}±0.141

T_1–Treatment 1 (without sheep and goat manure), T_2–Treatment 2 (5 t/ha sheep and goat manure), T_3–Treatment 3 (10 t/ha sheep and goat manure and T_4–Treatment 4 (15 t/ha sheep and goat manure.
Means with different superscripts differ at 5 per cent level of significance.

plant height in T_0 at early stage of crop growth might be due to the decreased amount of nitrogen in the soil which happened due to the absence of sheep and goat manure in the soil.

The stem length of treatment applied sheep and goat manure @ 10 t/ha produced significantly longer stem than other treatments; however, no significant difference was found between T_1 and T_3. The significant effect of nitrogen and phosphorus (different manure) application was reported by Ayub *et al.* (1997, 1999) and Tariq (1998).

An increase or decrease in number of leaves per plant had a direct effect on the yield of fodder crops. Data (Table 1) indicated the significant differences within the treatments for number of leaves per plant and significantly higher leaves per plant produced in all treatments than control. Maximum (13.50) number of leaves per plant was recorded in T_2 treatment where sheep goat manure dose @ 10 t/ha was applied (Table 1). The increase in number of leaves per plant in T_2 might be due to readily available nutrients and favourable conditions during the growth period of the crop. An increase in number of leaves per plant with fertilizer application was reported by Ragheb *et al.* (1987).

Green Fodder and Dry Matter Yield (t/ha)

Fodder yield is a function of genetic as well as environmental factors which play a vital role in plant growth and development. Green fodder yield was significantly affected both by different levels of sheep and goat manure (Table 1). All the treatments differed significantly from one another except T_2 and T_3. The treatment receiving sheep and goat manure @ 10 t/ha produced significantly higher green fodder yield (30.30±.07 t/ha) than the treatments which received sheep and goat manure @ 5 and 15 t/ha and control. The increase in yield with sheep and goat manure application was probably due to the higher number of leaves per plant, plant height and leaf area per plant. Results agree with the findings of Matkevish (1984), Kanwar *et al.* (1992) and Ali (2000).

Dry matter (DM) production was enhanced significantly with the application of different doses of sheep and goat manure (Table 1). All plots receiving organic manure gave significantly higher DM than control. The maximum DM yield (9.0±.28) recorded in treatments received sheep and goat manure @ 10 t/ha. The increase in DM yield was due to the higher number of leaves per plant, plant height and leaf area plant. Moreover, all the treatments with organic manure sheep and goat manure registered higher DM than no organic manure (control) at all the stages of crop growth. Application of such organic manure might have provided a continuous supply of nutrients and might have enabled the leaf to extend and thus providing an opportunity for the plants to increase the photosynthetic rate which could lead to the high DM yield. Khatun *et al.* (2014) also found the better yield of maize fodder when sheep and goat manure was applied @ 9.6 t/ha in organic manure and the maximum biomass yield was 31.6 t/ha of land.

Nutritive Value of Maize Fodder

DM of maize fodder for all treatments was affected significantly at each increased rate of manure (Table 2). The higher value of DM (29.5±0.707%) for whole fodder was recorded from the plots applied sheep and goat manure @ 10 t/ha and plots receiving no manure

TABLE 2
Mean with standard deviation of the chemical composition of whole maize fodder

Parameter	Treatments			
	T_1	T_2	T_3	T_4
DM (%)	26.5^{a}±0.707	27.5^{b}±0.707	29.5^{c}±0.707	29.25^{c}±0.354
CP (%)	7.90^{a}±0.141	10.75^{b}±0.354	10.85^{b}±0.919	11.00^{b}±0.707
ADF (%)	48.75^{a}±1.06	52.50^{b}±0.707	57.00^{c}±0.707	56.95^{c}±0.778
Ash (%)	10.75^{a}±0.354	13.00^{b}±0.707	13.25^{b}±0.354	13.00^{b}±0.283

Treatment details are given in Table 1.
DM–Dry matter, CP–Crude protein, ADF–Acid detergent fibre.
Means with different superscripts differ at 5 per cent level of significance.

maize fodder contained the lower values of DM (26.5±0.707%) at harvesting time. There was no significant difference of DM (%) between the treatments T_2 and T_3. The results are confirmatory with those of Ahmed (1999).

Protein content is one of the major ingredients determining the fodder quality and was significantly influenced by different levels of sheep and goat manure application (Table 2). Significant increased level of crude protein (CP) was observed at each increased level of manure. A maximum and minimum CP were recorded when sheep and goat manure was applied @ 15 t/ha (T_3) and 0 t/ha (T_0), respectively. CP content in whole maize fodder was higher (11.00±0.707%) in treatment receiving higher dose of sheep and goat manure; however, there was no significant difference between T_2 and T_3. Nitrogen, being a basal component of amino acid, might have enhanced the protein content with increased level of manure. Similar findings were reported by Ahmed (1999) and Ali (2000).

The maximum value of acid detergent fibre (ADF) content was observed with treatment T_2 of whole fodder which was 57.00±0.707 per cent, whereas the minimum value of ADF content in treatment T_0 of whole plant. ADF content of maize fodder in treatments T_2 and T_3 was similar.

Table 2 shows that the ash percentage was influenced by different levels of sheep and goat manure. The ash percentage of maize fodder was statistically higher for all treatments applied sheep and goat manure compared to control. Maximum ash (13.25±0.354%) was obtained in treatment applied sheep and goat manure @ 10 t/ha; however, there was no significant difference in ash among the treatments applied different doses of the sheep and goat manure. The results coincide with the findings of Ayub *et al.* (1997 and 1999), Cheema (2000) and Husnain (2001) who have reported the increase in ash percentage with nitrogen fertilizer application.

Physical Evaluation of Silage

In case of drum silage, the colour of silage prepared with only maize (Silage 1) and silage prepared with maize with molasses (Silage 2) was greenish which indicated the quality of maize with molasses silage was very good, whereas silage prepared with maize with urea and molasses (Silage 3) was light brownish and for all types of silage the aroma was pleasant, so, the silage quality was good.

In case of bag silo, the colour of silage was blackish and was contaminated fungus and odour was bad. This happened due to the leakage of bag after one month of silage preparation. Therefore, this silage was not considered for further chemical analysis and feeding of animal.

pH of Silage

The pH and chemical composition of silage are shown in Table 3. It was observed that the pH was good (4.08) in silage prepared with molasses than silage prepared from only grass. However, silage made with molasses and urea contained pH 4.69 which indicated medium type silage. This happened due to the presence of urea in molasses and increased CP content.

TABLE 3
Nutritional composition (mean ± standard deviation, g/100 g DM) of maize fodder silage

Parameters	Silage 1	Silage 2	Silage 3
pH	4.66^{b}± 0.055	4.08^{a} ± 0.010	4.69^{b} ± 0.010
DM	21.51^{b} ± 0.490	17.40^{a} ± 0.40	18.28^{a} ± 0.396
CP	9.78^{a} ± 0.280	9.80^{b}± 0.200	10.59^{c} ± 0.090
CF	34.04^{b} ± 0.540	33.50^{b} ± 0.500	28.23^{a} ± 0.230
EE	2.55^{a} ± 0.050	2.64^{b} ± 0.020	4.05^{c} ± 0.05
Ash	15.40 ± 0.400	15.71 ± 0.210	15.50 ± 0.05
NFE	38.23^{a} ± 1.270	38.35^{b} ± 0.470	41.63^{c} ± 0.870
ME (kcal/kg)	1741.78^{a} ± 28.913	1753.07^{b} ± 10.379	1991.71^{c} ± 21.994

DM–Dry matter, CP–Crude protein, ADF–Acid detergent fibre, CF–Crude fibre, EE–Ether extract, NFE–Nitrogen free extract and ME–Metabolizable energy.
Means with different superscripts differ at 5 per cent level of significance.

Chemical Composition of Silage

The different chemical compositions such as DM, CP, EE, Ash and CF per cent were estimated, which are shown in Table 2. DM content of silage was higher in silage prepared using only fodder was 21.52 per cent at silage opened in first time. The silage prepared using maize with molasses and urea contained the second amount most of DM (18.28±0.396%), whereas silage made with maize and molasses contained the lower (Table 2). The ash was higher (15.7%) in silage prepared with maize and molasses than silage prepared with maize, molasses with urea and only maize. However, there was negligible variation of ash content among the three different silages.

The crude protein (CP) content was higher in silage prepared with molasses and urea (Silage 3). In that case urea may increase the CP value of silage. The second higher amount (9.98%) of CP was in silage made using only maize fodder. However, the differences of CP content of silage 1 and 2 were negligible.

The average crude fiber (CF) of silages 1, 2 and 3 was 34.03, 33.5 and 28.23, respectively, during first time opening of silo pit. CF content of silage 1 and 2 was higher than silage 3. The average ether extract (EE) of silages 1, 2 and 3 was 2.55, 2.64 and 4.05, respectively, first time opening. EE content of silage 3 was highest than silages 1 and 2.

Nutritive Value of Silage between Two Opening Times

The silages were closed after opening first time then two months later the drum silage was again opened and analyzed its pH and proximate component which are shown in Table 4. It was observed that the pH increased for all three silages at second time opening compared to first opening. In case of chemical composition the DM also decreased from 9.8-10.59 to 9.2-10.32 for three silages. All other compositions such as CP, CF and Ash percentage also decreased proportionally in second opening of silage.

Dry Matter and Ash Content of Different Unconventional Tree Leaves

Dry matter (DM) and ash content of different tree fodder are shown in Table 5. The DM content was higher in case of Krisnachura leaf (34%) and lower for water hyacinth (17.25%). The DM percentage of Mehogony, Chrismass tree, Krisnachura, Koroiu and Bamboo leaves ranged from 25 to 17.25 per cent. The ash content was higher in case of bamboo leaves (14.5 g/100 g DM) and lower for Kori (4.11 g/100 g DM) and Neem leaf and Ipil-ipil leaf contained (11 g/100 g DM). The ash per cent of other leaves ranged from 7-13. Zamal *et al.* (2008) analyzed Ipil-ipil (*Leucaena leucocephala*) and Koroi leaf and reported 10 and 5.40 per cent ash, respectively. Ash of Kanchan flower was recorded 8 per cent by Emir (2011) and in Neem 10 per cent by Odunsi *et al.* (2009). These findings are in close association with the findings of the present study.

Crude Protein and Crude Fibre Content of Different Unconventional Tree Leaves

Crude protein (CP) and crude fibre (CF) contents of different tree leaves are shown in Table 3. The crude protein content was higher in Dhaincha (sesbania) leaf (25.5 g/100 g DM) and lower (9.2 g/100 g DM) in bamboo leaf and other leaves CP ranged from 10.70 to 23 g/100 g DM. The Ipil-ipil (*Leucaena*

TABLE 4
Comparison of silage sample in two opening times (g/100 g)

Parameters	Time at first opening			Time at second opening		
	Silage1	Silage 2	Silage 3	Silage 1	Silage 2	Silage 3
pH	4.69	4.08	4.69	4.69	4.69	5.00
DM (%)	21.52	17.40	18.56	18.71	17.17	17.53
CP (%)	9.78	9.8	10.59	9.2	9.67	10.32
CF (%)	34.03	33.5	28.23	29.63	26.86	27.75
EE (%)	2.55	2.64	4.05	2.52	2.60	4.00
Ash (%)	15.40	15.71	15.50	10.92	14.03	15.9

Parameter details are given in Table 3.

TABLE 5
Chemical composition of twelve selected tree leaves (g/100 g)

Tree leaves	Ingredients						
	DM (%)	Ash (%)	EE (%)	CP (%)	CF (%)	NFE (%)	ME (kcal/kg DM)
Krisnachura leaves	34	6.56	6	20	30.4	37.04	2295
Ipil-ipil leaves	27	10	5	23	20.50	41.5	2466.76
Neem leaves	28	11	6	14	30	39	2161.98
Kanchan flower	27	8	4	21	28	36	2105
Rain tree leaves	30	9	2	11	31	34	1601
Christmas tree	28	6	3	12	33	33	1675.96
Mahogany leaves	31	7	11	13	25	27	2104
Koroi leaves	30	4.51	13.4	15.8	14.8	7.29	1776
Water hyacinth	17.25	10.23	2.4	10.70	18.50	58.17	2418
Bamboo leaves	25	14.5	1.0	9.2	24	51.3	2038
Jackfruit leaves	27	13.5	1.2	12.5	25.30	47.5	2061
Dhaincha leaves	24	7.5	4.5	25.5	18.5	44	2594.44

Ingredient details are given in Table 3.

leucocephala) leaf contained CP 23±0.12 per cent (Zamal *et al.* 2008), which is similar to the present study. CP of Neem leaf was found 14 g/100 g DM. This is similar to the observation of Odunsi *et al.* (2009). The CF content was higher in Christmass tree (33%) and lower in water hyacinth (18.5 g/100 g DM). The CF percentage of Ipil-ipil (*Leucaena leucocephala*) leaf was observed 41 by Zamal *et al.* (2008) and for Neem was 36 as observed by Odunsi *et al.* (2009).

Ether Extract and Nitrozen Free Extract of Different Unconventional Tree Leaves

The ether extract (EE) content was higher in Krishnachura and Neem (6 g/100 g DM) and lower in bamboo leaf (1%) and it ranged from 1.2 to 5 g/100 g DM. The EE per cent of Ipil-ipil (*Leucaena leucocephala*) leaf was 6 (Zamal *et al.*, 2008), Koroi 10.15 and Kanchan flower 4 (Emir, 2011).

The nitrogen free extract (NFE) percentage of all tree leaves was close to each other and ranged from 33-51 g/100 g DM. NFE in Neem was recorded 33 per cent by Odunsi *et al.* (2009), which was lower than the current study.

Metabolic Energy of Different Unconventional Tree Leaves

The metabolic energy (ME) was higher in Dhaincha (2105 kcal/kg) and lower in rain tree leaves (16041 kcal/kg). ME of other leaf ranged from 1675 to 2467 kcal/kg. The ME of Kanchan flower was reported 2110 kcal/kg by Emir (2011) and for Neem was 2000 kcal/kg by Odunsi *et al.* (2009).

Nutritive Value of Unconventional Seeds and Byproduct

The chemical composition of different unconventional seeds and byproduct is shown in Table 6. Rubber seed meal contained 2794.44 kcal/kg ME, 88.6 per cent DM, 26.07 g CP, 16.9 g CF, 10.5 g EE, 36.13 g/100 g NFE, which is close to the results of Ekenyem *et al.* (2006).

From Table 6, it was observed that rain tree seed contained higher amount of protein (28.5 g/100 g DM) but lower fiber (15 g/100 g DM). The ME and EE were obtained in rain tree seed 2751.78 kcal/kg and 5.0 g/100 g, respectively which is close to FAO (2002). In the present study, wheat bran contained 1205 kcal/kg ME, 11.5 g CP, 21.5 g CF, 4.5 g EE and 7.41 g/100 g ash, which is similar to the finding of Huque (1993).

Gram husk (*Cicer arietinum*) contained 1751.74 kcal/kg ME, 87.8 per cent DM, 4.56 g CP, 49 g CF, 5.0 g EE, 38.24 g NFE and 3.2 g/100 g ash. About 5.1 g CP and 11.0 g/100 g EE's in gram husk was recorded by Sreerangarajua *et al.* (2000). The proximate composition of Bengal gram (*Cicer arietinum*) husk is comparable to that of cereal straw (Sen *et al.*, 1978). Barry (1989) reported that gram husk contained some anti-nutritional

TABLE 6
Chemical composition of unconventional seed and byproduct (g/100 g)

Unconventional seeds and byproduct	Ingredients						
	DM (%)	CP (%)	CF (%)	EE (%)	NFE (%)	Ash (%)	Energy
Rubber seed meal	88.60	26.07	25.50	10.50	36.13	1.80	2794.44
Rain tree seed	87.5	28.5	15	5.6	46.9	4.00	2751.78
Gram husk	87.8	4.56	48.5	2.50	31.7	11.5	1751.74
Pea husk	88.5	5.8	48.5	2.5	31.7	1.80	1391.93
Wheat bran	86.5	11.5	21.5	4.5	55.09	7.41	2472.67

Ingredient details are given in Table 3.

factors, particularly certain types of tannins. So, gram husk can be cautiously used in ruminant ration.

It was observed that pea husk (*Pisum sativum*) contained 1391.93 kcal/kg ME, 88.5 g DM, 5.8 g CP, 48.4 g CF, 2.5 g EE, 31.7 g NFEs and 11.5 g/100 g ash (Table 6), which is similar to the finding of FAO (2002). According to Gowda *et al.* (2004), pea husk contained 92.3 g DM, 6.0 g CP, 1.1 g EEs, 42.6 g CF, 5.0 g ash and 45.2 g/100 g nitrogen free extracts.

CONCLUSION

It can be concluded that the green fodder biomass, dry matter and botanical fractions of maize were dependent on the dose level of sheep and goat manure with inorganic fertilizers. The application of 10 t/ha sheep and goat manure produced highest maize fodder yield. Two types of silage were prepared with bag silo and drum silo methods and it could be seen that the bag silo produced spoiled silage. However, the drum silo produced good quality silage in terms of physical and chemical characteristics. Among the three different drum maize silages, which contained maize with molasses and urea showed highest pH, CP, EE, NFE and ME than other silage. However, the pH value was suitable and ash percentage was higher in silage prepared with maize and molasses than silage prepared with maize with urea and only maize. The various unconventional tree leaves and seeds were collected and evaluated and it was observed that the Dhaincha leaves contained highest energy and CP than Ipil-ipil and Krisnachura and other tree leaves. Christmas and Krisnachura tree leaves had higher CF than other tree leaves. Among the five fodder seeds and byproduct the rain tree and rubber seed contained highest DM, CP, EE and Energy than other feeds. It was suggested that all studied tree leaves and byproduct could be used for alternative feed resources for livestock feed. Furthermore, Dhaincha, Ipil-ipil, rain tree and rubber seed could be used as livestock and poultry feed ingredients due to its high protein and energy value. However, before the use this unconventional feed with the ration its anti-nutrient factor, toxicity should be measured. The inclusion of level of these feed ingredients need to identify with animal trail and an indebt study throughout the year with more replications is needed.

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