The Agriculturists 13(1): 01-08 (2015) ISSN 2304-7321 (Online), ISSN 1729-5211 (Print)
A Scientific Journal of Krishi Foundation ***Indexed Journal***

Production and Nutritional Quality of High Yielding Fodders in the Coastal Areas for Ruminants

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Received: 28 May 2014 Accepted: 06 June 2015

Abstract

The experiment was conducted to study the production and nutritional values of high yielding fodders by the goat farmers in Kobirhat and Subornochar upazilas of Noakhali District. The yields of high yielding forages had significant differences among the species. The average higher biomass were obtained from Napier–hybrid (34), Napier-aerosa (20), Napier–bazra (17.33) and Splendida (19). The Andropogon and Signal fodder had similar yields of 12.67 & 13.67 t/ha/cut. There was a significant ($P<0.05$) variations in the DM contents among the forages. The DM content (%) of Napier varieties ranged from 19.60 to 22.30, and highest value was found in Ruzi (27.90). A non-significant ($P<0.05$) differences were observed in the CP content (%) among the Napier and Splendida varieties. There was no significant difference in metabolizable energy content (MJ/kgDM) among the forages. The cultivation of high yielding fodders e.g. Napier hybrid, Napier aerosa, Napier bazra and Splendida may be practiced in the saline areas of Noakhali for high productivity of ruminants.

Keywords: Napier, splendida, crude protein, metabolizable energy

1. Introduction

The coastal saline soils in Bangladesh occupy an area of 1.5 million hectares, of which about 1.0 million ha is cultivable (BARC, 1997). The area includes parts of 12 districts out of 64 namely Khulna, Satkhira, Borguna, Perojpur, Cox's Bazar, Bagerjat, Patuakhali, Bhola, Noakhali, Feni, Laxmipur and Chittagong. Fallow-T.Aman-Fallow is the predominant cropping pattern in this saline area. Although double cropping (Fallow-T. Aman - Rabi) is practiced in some areas, triple cropping (T. Aus-T. Aman-Rabi) is rare. This soil is highly saline, organic matter and nitrogen deficient, and there is lack of sweet water in the dry season, but has adequate phosphorus. There is a great potential of growing salt tolerant forages in these vast fallow and saline soils where other crops cannot be grown. The yields of perennial grasses per year are higher in this area due to frequent cuttings in 40-45 days interval (Islam *et al.*, 2001).

Napier (*Pennisetum purpureum*) is a perennial grass grown widely as a fodder crop and feed for cut and carry zero grazing dairy systems (Bayer, 1990) and constitutes up to 80% of forage for smallholder dairy farms (Staal *et al.*, 1987). It is the forage of choice not only in the tropics but also worldwide (Hanna *et al.*, 2004) due to its desirable traits such as tolerance to drought in wide range of soil conditions, high photosynthetic and water use efficiency (Anderson *et al*., 2008).

While much attention has been directed towards research for improving the productivity of major cereal crops, there has been comparatively little effort to improve Napier grass-an important forage crop that has been grown over centuries and currently enjoys a multiplicity of uses besides conventional animal consumption (Jaradat, 2010).

Although biomass yield is the single most important criteria to select a fodder, there are other criteria like nitrogen and energy content which are very important to be considered in selecting a fodder. The nutritive value of different fodder within the same plant may vary and the animals have the opportunity to select succulent parts of the fodder in preference to others. Among non-legume perennial fodder, the yield potential of Napier (*Pennisetum purpureum*) grass was higher than others in early establishment of native climatic condition of Bangladesh (Kibria *et al*., 1991). At present, five varieties of Napier grasses (bazra, aerosha, hybrid, pusha and India-17) have been cultivated and cuttings have also been distributed among the interested farmers who want to cultivate Napier. Such study may be valuable for the coastal farmers to select suitable fodder varieties to improve their livestock. An experiment was therefore conducted to study the production and nutritional values of high yielding fodders by the goat farmers in saline areas of Kobirhat and Subornochar upazilas in Noakhali.

2. Materials and Methods

2.1. Selection of grasses

Coastal locations are characterized by slightly, moderately and highly saline. Ten perennial grasses were cultivated in May 2010 at three sites of Noakhali district to investigate the yield potential of the grasses in coastal areas using a randomized complete block design. The areas are Southern Agro Trade (salinity 5-6 dS/m), Kobirhat upazila (salinity 6-7 dS/m) and Subornochar upazila (salinity 8-10 dS/m). Twenty farmers were selected under each site. During land preparation fermented cow dung was applied @ of 35 kg/decimal.

The grasses were propagated by stem cutting method. Line to line and plant to plant distances were 70 and 35 cm, respectively. Weeding and irrigation were done when necessary. During land preparation, Phosphate (TSP) and MP fertilizer were applied @150 and 125 kg/ha, respectively. Urea @ 50 kg was applied 20-30 days after transplanting followed by 50 kg urea was applied after 10-12 days of each cutting. The perennial grasses were Napier-bazra, Napier-aerosa & Napier -hybrid (*Pennisetum purpureum*), Andropogon (*Andropogon gyanus*), Splendida (*Setaria splendida*), Ruzi (*Brachiaria ruziziensis*), Guinea (*Panicum maximum*), Signal (*Brachiaria decumbens*), Para (*Brachiaria mutica*) and German (*Echinoclora crousgalli*).

2.2. Cutting interval and cutting number

Grasses were harvested at a regular interval at 40-45 days after each cutting, while first cut was made 55-60 days after the establishment. The similar intervals for each grass were nearly 10 cutting number (harvests) commencing from the start of the experiment.

2.3. Chemical analysis of samples

The forage samples were subjected to chemical analysis for the determination of the dry matter (DM), organic matter (OM), crude protein (CP) and ash following the Methods of AOAC (1995). The acid detergent fibre (ADF) was determined according to Goering and Van Soest (1970). All the samples were analyzed in duplicate and the mean values were recorded. According to ARC (1980), DOMD (%) = 75.73-0.269 x ADF%, ME (MJ/kg DM) = DOMD x 0.15.

2.4 Statistical analysis

The statistical analysis was done using 'SPSS 11.5' statistical programme to compute analysis of variance (ANOVA) for randomized complete block design (RCBD). Differences among the treatment means were determined by Duncan′s Multiple range Test (Duncan, 1955).

3. Results and Discussion

3.1. Selection of salt tolerant grasses

The height biomass yield (t/ha/cut) obtained from Napier varieties (35.12) and Splendida (20.03), whilst the lowest was from Ruzi (6.01), which was about one-sixth of the amount of the highest (Table 1). Therefore, Ruzi cannot be selected under any circumstances. In general, grass yield (t/ha/cut) was higher in the saline areas of Subarnachar followed by Southern Agro Trade of Subornochar and Kobirhat upazila. However it is clear, that four grasses namely Napier bazra, Napier aerosa, Napier hybrid and Splendida could be grown in saline areas to get higher biomass yield compared to other grasses included in this trial (Figure 1).

Biomass yield (t/ha/year) was highest for Napier hybrid (204) followed by Napier aerosa (120), Napier bazra (104) and Splendida (114), whereas yield was the lowest for Ruzi (56) (Figure 2). These grasses may be screened for saline areas. Similar yield was found in the plain land areas of BLRI (Islam *et al.*, 2001). It seems that Napier and Splendida may be introduced in all location of studied areas.

3.2. Biomass yield

The average higher biomass (t/ha/cut) was obtained from Napier hybrid (34), Napier aerosa (20), Napier bazra (17.33) and Splendida (19) and the lowest was from Ruzi (8). Andropogon and Signal had similar yield (Figure 1). These results indicate that Napier varieties and Splendida always have higher biomass yield while Ruzi had the lowest. Kibria *et al.* (1993) stated that among non-legume perennial fodders, Napier yield was higher than others in native climatic condition of Bangladesh. Sarker *et al.* (2013) reported that the biomass yield of Napier hybrid in the areas of Savar, Dhaka was 48.21 t/ha/cut.

Table 1. Effect of types of perennial grasses on biomass yield (t/ha/cut)

SL. No.	Fodder species	Fodder Yield (t/ha/cut)			Level of sig.
		Southern Agro Trade Subornochar	Kobirhat upazila	Subornochar upazila	
1	Napier bazra (*Pennisetum purpureum*)	18.11±0.91	16.12±0.87	18.10±0.96	NS
2	Napier aerosa (*Pennisetum purpureum*)	20.09±1.02	19.08±0.98	21.06±1.21	NS
3	Napier hybrid (*Pennisetum purpureum*)	34.12±1.23	33.11±1.32	35.12±0.92	NS
4	Andropogon (*Andropogon gyanus*)	13.02±0.11	11.06±0.69	14.03±0.57	NS
5	Splendida (*Setaria splendida*)	19.09±1.01	18.05±1.11	20.03±0.86	NS
6	Ruzi (*Brachiaria ruziziensis*)	8.02^{b}±0.85	6.01^{a} ±0.99	10.02^{b}±0.75	*
7	Guinea (*Panicum maximum*)	12.05^{b} ±1.11	9.04^{a} ±0.68	13.06^{b} ±0.75	*
8	Signal (*Brachiaria decumbens*)	14.08±0.88	13.06±0.63	14.10 ±0.84	NS
9	Para (*Brachiaria mutica*)	12.05±0.77	11.12±1.02	12.11 ±1.01	NS
10	German (*Echinoclora crousgalli*)	11.13±0.98	9.09 ±0.89	10.68±0.76	NS

^{ab} Mean values in a row with different superscripts differ significantly, NS= Not significant, *P<0.05

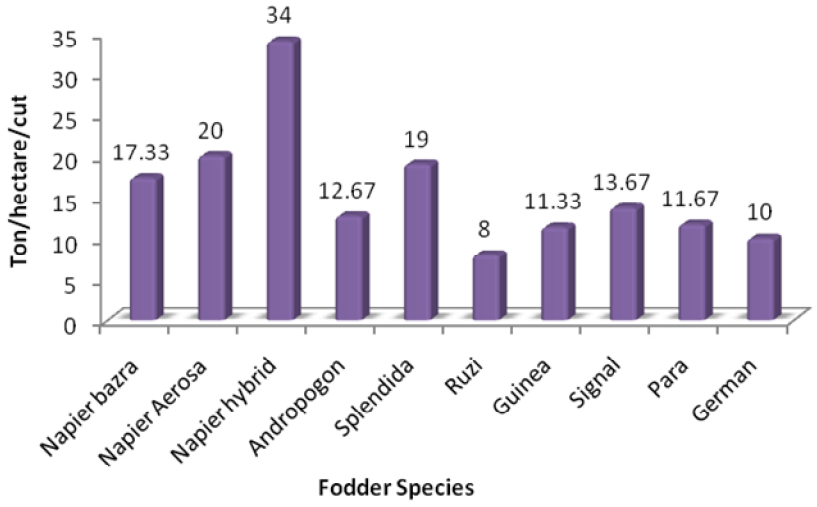

Figure 1. Effect of types of grasses on biomass yield of diffirent types of fodder species per cut

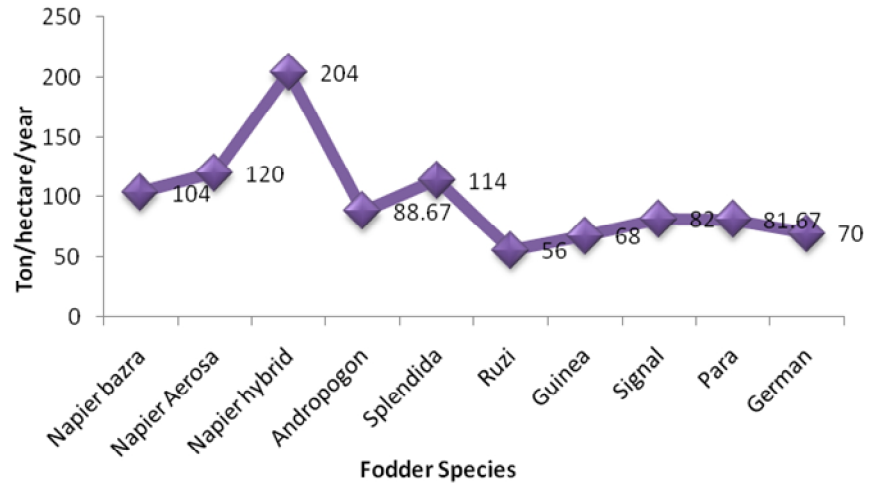

Figure 2. Effect of types of grasses on biomass yield of fodder species per year

Table 2. Effect of types of perennial grasses on chemical composition

SL. No.	Fodder species	DM (g/100g fresh matter)	g/100g DM			
			Ash	OM	CP	ADF
1	Napier bazra (*Pennisetum purpureum*)	19.60^{a} ±1.22	7.90^{b}±1.56	92.10±2.89	7.80^{b} ±0.45	38.80^{b}±3.89
2	Napier aerosa (*Pennisetum purpureum*)	21.40^{a} ±1.35	10.30^{c}±1.11	89.70±3.11	7.50^{b}±0.56	25.80^{a}±4.21
3	Napier hybrid (*Pennisetum purpureum*)	22.30^{ab} ±1.51	10.40^{c}±1.56	89.60±2.33	7.90^{b}±0.35	26.50^{a}±3.56
4	Andropogon (*Andropogon gyanus*)	26.70^{b} ±1.32	5.80^{a}±0.92	94.20±3.33	5.90^{a} ±0.69	40.90^{b}±4.11
5	Splendida (*Setaria splendida*)	24.60^{b} ±1.46	7.80^{b}±0.91	92.20±1.97	7.20^{b} ±0.89	27.50^{a}±3.33
6	Ruzi (*Brachiaria ruziziensis*)	27.90^{b} ±1.67	6.20^{a}±0.88	93.80±2.56	8.90^{b}±0.87	42.90^{bc}±4.63
7	Guinea (*Panicum maximum*)	24.30^{b} ±0.96	7.50^{b}±0.75	92.50±2.41	8.20^{b}±0.59	31.80^{a}±2.96
8	Signal (*Brachiaria decumbens*)	27.80^{b} ±1.78	6.60^{a}±.071	93.40±3.76	6.80^{b}±0.63	39.40^{b}±4.23
9	Para (*Brachiaria mutica*)	26.70^{b} ±2.12	5.30^{a}±0.44	94.70±2.44	7.40^{b} ±0.87	48.70^{c}±4.68
10	German (*Echinoclora crousgalli*)	24.50^{b} ±1.96	5.40^{a}±0.23	94.60±2.99	9.20^{b} ±0.96	47.50^{c}±4.89
	Level of significance	*	*	NS	*	*

^{abc} Mean values in a row with different superscripts differ significantly, NS= Not significant, *P<0.05,

Table 3. Effect of types of perennial grasses on metabolizable energy content (MJ/kgDM)

SL. No.	Fodder species	Metabolizable Energy content (MJ/kgDM)
1	Napier – bazra (*Pennisetum purpureum*)	9.8±0.86
2	Napier–aerosa (*Pennisetum purpureum*)	10.3±0.83
3	Napier–hybrid (*Pennisetum purpureum*)	10.2±0.76
4	Andropogon (*Andropogon gyanus*)	9.7±0.88
5	Splendida (*Setaria splendida*)	10.2±0.75
6	Ruzi (*Brachiaria ruziziensis*)	9.6±0.98
7	Guinea (*Panicum maximum*)	10.1±1.05
8	Signal (*Brachiaria decumbens*)	9.7±0.95
9	Para (*Brachiaria mutica*)	9.4±0.85
10	German (*Echinocloa crous-galli*)	9.4±0.87
	Level of significance	NS

3.3. Nutritive value of grasses

Table 2 shows that there were significant ($p<0.05$) differences in the DM, Ash, CP and ADF contents of the grasses. The DM contents of Napier varieties were lower than those of other forages. The DM content of Napier varieties ranged from 19.60 to 22.30 and higher in Ruzi (27.90). Ruzi and Signal contained higher DM than Andropogon, Para, German, Guinea and Splendida. Napier hybrid had the highest Ash content but had lower ADF. Para had the lowest Ash content but highest ADF content. There were no significant differences in respect of CP contents among the forages, except Andropogon. The high productive Napier varieties contained CP (%) ranging from 7.50 to 7.90 and Splendida contained CP of 7.2. The ADF content of Napier bazar was significantly ($p<0.05$) higher than those of Napier aerosa, Napier hybrid and Splendida. These finding agreed with that reported by Islam *et al*. (2001). The use of forage has focused the attention of many researchers, due to the fact that these feed resources are perennial (Singh, 1995; Leng, 1997) and particularly appropriate for small ruminants (Van Eys *et al.,* 1986; Robertson, 1988; Chen *et al.,* 1992; Norton, 1994; Kaitho, 1997).

The metabolizable energy content (MJ/kgDM) was similar in all the forages ranging from 9.4 to 10.3 (Table 3). Therefore, the biomass yield was the most important criterion for selecting forages and was not only the nutritive value, particularly ME.

4. Conclusions

Napier–hybrid, Napier-aerosa, Napier–bazra and Splendida yielded higher biomass than other varieties. One of the most important characteristics of these grasses is that they can be grown in saline areas. Another advantage of cultivating these perennial grasses is that once established they can supply fodder for about five years and cutting can be done in every 40-45 days. The nutritive values in terms DM, OM, CP, ADF and Ash contents were good in the fodders. The highest fodder production was found in Napier hybrid, followed by Napier aerosa, Napier bazra and Splendida. The cultivation of high yielding fodders e.g., Napier hybrid, Napier aerosa, Napier bazra and Splendida may be practiced in the saline areas of Noakhali for high productivity of ruminants.

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