International Journal of Applied Research
Journal HP: www.intjar.com, ISSN: 2411-6610

Impact of loamy and sandy soils on productive and nutritive value of BLRI developed Napier-4 fodder at third cutting stage

Mohammed Sirajul Islam[1], Nathu Ram Sarker[2], Md. Yousuf Ali[1], Md. Ahsan Habib[2], Md. Mostain Billah[1]*, Mohammad Salah Uddin[3] and Md. Rezwanul Habib[1]

[1]Bangladesh Livestock Research Institute Regional Station, Baghabari, Shahjadpur, Sirajganj-6770, Bangladesh
[2]Bangladesh Livestock Research Institute, Savar, Dhaka-1341, Bangladesh
[3]Bangladesh Milk Producers Co-operative Union Limited

ARTICLE INFO

Article history

Accepted 25 Feb 2018
Online release 10 Mar 2018

Keyword

Loamy and sandy soil
Napier-4
Dry matter
Metabolizable energy

***Corresponding Author**

Md. Mostain Billah
Email: mostainbau@gmail.com

ABSTRACT

Present research work was undertaken to know the impacts of loamy and sandy soils on production performance and nutritive value of BLRI developed Napier-4 fodder at third cutting stage. Hence, both types of soil constituents were assayed for knowing the soil properties like pH, nitrogen, organic matter, salinity and mineral contents. Records of production parameters such as plant height, stem length, leaf length, number of leaf per stem, number of till per hill, yield per hill and total biomass yield of the fodder were maintained. Also, dry matter, crude protein, crude fiber, ash and metabolizable energy content of the Napier-4 fodder were studied. Results revealed that numerically higher ($P<0.001$) productive parameters (except till per hill) found in loamy soil than sandy soil. All the nutritive parameters of Napier-4 fodder did not differ significantly ($P>0.05$) in both type of soils but higher metabolizable energy and dry matter content of Napier-4 fodder found in loamy soil than sandy soil. Considering above mentioned parameters, it is concluded that BLRI developed Napier-4 fodder showed better performance in loamy soil than sandy soil at third cutting stage.

Introduction

Napier (*Pennisetum purpureum*) is a perennial green grass which grown widely as a fodder crop and used as feed for cut and carry zero grazing dairy systems (Bayer, 1990). Napier grass is also known as elephant grass or Uganda grass (Khan et al., 2007). Napier grass is the most important fodder crop for the dairy farmers in Asian countries. Its high productivity makes it particularly suited to feed cattle and buffaloes. It constitutes up to 80% of forage for smallholder dairy farms (Staal et al., 1987) as well as feeding of dairy heifers (Habib et al., 2018) and most of the milk pocket areas in Bangladesh (Islam et al., 2017a). It is the forage of choice not only in the tropics but also worldwide (Hanna et al., 2004) due to its desirable traits like tolerance to drought in wide range of soil conditions, grazing has made productive use of arid lands for food production, high photosynthetic and water use efficiency (Anderson et al., 2008). Napier grass is being valuable to country landscapes as it prevents soil erosion; serve as a fire break, a wind break and to improve soil fertility (Farrell et al., 2002).

Fodder plays an important role in economizing the cost of production of livestock products especially of milk. Feeds and fodder constitute about 60-70% cost of total cost in dairy farming (Grover & Kumar, 2012) but grazing land of animal and fodder cultivation land in Bangladesh is decreasing day by day due to population development pressure. Currently the demand for green grasses is estimated at about 70 million metric tons and produced only about 24 million metric tons in the country. Fodder deficiency is near about 66 percent. To eradicate this deficiency, Bangladesh Livestock Research Institute has recently developed and distributed 13 high yielding green fodders like Napier and Jumboo to the dairy farmers for cultivation. Productive and nutritive value of fodder depends on soils types, soil nutrients, fertility and texture. Soil has many categories which rely on composition and texture like sandy, clay, loamy, silt clay, silt loam, silt clay-loam and sandy loam etc. Among these, sandy and loamy soils occupy major land for crop and fodder cultivation in this country. Recently, Islam et al. (2017b) carried out a research work regarding the soil effects on BLRI Napier-4 fodder upto 2nd cutting in respect of production performance only but no other research work yet has been done regarding Napier-4 fodder cultivar soil effects upto 3rd stage on productive as well as nutritive value. Hence, this study was undertaken to investigate the loamy and sandy soil effects on productive parameters as well as nutritive value of BLRI Napier-4 fodder.

Materials and Methods

Experimental site and layout

The experiment was conducted at Bangladesh Livestock Research Institute (BLRI) Regional Station, Baghabari, Shahjadpur, Sirajganj-6770. Bangladesh has divided into 30 agro-ecological zones (AEZ) based on soil type and texture which AEZ-1 to AEZ-30. Among all AEZ, this study area was belongs to Karatoya-Bangali flood plain agro-ecological zone (AEZ-4).

Cultivation procedure

BLRI Napier-4 fodder was cultivated in both loamy and sandy soils. These loamy and sandy soils were considered as treatments and each having three

replicational plots. Each of the plot size was 17ft × 10ft. BLRI developed high yielding Napier-4 fodder was propagated by stem cutting method and sowed in rows. Line to line and plant to plant distances were 70 and 30 cm, respectively. Weeding was performed for removing undesirable grasses, bushes and plants according to the schedule with the aid of utensils like sickle, chen, spade etc. were done to Irrigation was done by using plastic pipe through a canal with the help of deep tube-well.

Table1. Composition of loamy and sandy soils

Soil constituents	Types of soil	
	Loamy	Sandy
pH	6.21	6.58
Organic Matter (%)	1.73	0.36
Total Nitrogen (%)	0.085	0.019
Potassium (Millitulanko/100g)	0.14	0.12
Calcium (Millitulanko/100g)	8.01	0.81
Magnesium (Millitulanko/100g)	1.47	0.41
Sodium (Millitulanko/100g)	0.14	0.13
Phosphorus (µg/g)	11.60	16.80
Sulphur (µg/g)	2.49	1.47
Boron (µg/g)	0.58	0.22
Copper (µg/g)	1.26	0.41
Iron (µg/g)	55.60	19.19
Manganese (µg/g)	4.20	0.81
Zinc (µg/g)	3.33	0.44

Data recording and proximate analysis at third cutting stage

During third cutting stage various productive parameters were studied. Plant height, stem length, leaf length of the fodder was measured by using measuring tape in centimeter (cm). Also, records were taken for number of leaf per stem, number of till per hill, yield per hill (kg) and total biomass yield (Ton/acre). The representative fodder samples were collected from each treatment at the time of harvesting. Freshly harvesting fodder samples were chopped into small pieces up to 1-2 cm, weighed and sun dried for 2-3 d. After proper sun drying, the samples were kept in a drying oven (DZF series hot air vacuum drying oven DZF-6050 vacuum drying oven, Xingang, Tianjin, China) at a temperature of 105ºc for determination of dry matter. The dried samples were then grounded by using grinding machine (Christy and Nornis Limited, England, Serial No.: 47466). After grinding, the samples were kept into polythene bag, labeled and stored for chemical analysis. Then BLRI developed Napier-4 fodder was analyzed as described by AOAC (2000) for knowing the different nutrient contents at Animal Nutrition Laboratory, Bangladesh Livestock Research Institute Regional Station, Shahjadpur, Sirajganj-6770.

Statistical Analysis

One way ANOVA was performed using statistical package for the social science software (SPSS, IBM-17 Corporation, 2014) to investigate the soil effects on productive and nutritive value of Napier-4 fodder.

Soil properties

Loamy and sandy soils were tested for pH, nitrogen, organic matter, salinity and mineral contents at the Central Laboratory of Soil Resource Development Institute (SRDI), Krishi Khamar Sharak, Farmgate, Dhaka. Constituents of loamy and sandy soils are given in Table 1.

Results and Discussion

Effect of soil types on production performances of Napier-4 fodder

Effect of loamy and sandy soils on production performance of BLRI Napier-4 cultivar is shown in Table 2. Results revealed that plant height, steam length and leaf length of loamy soil is significantly differed from sandy soil and higher productive values found in loamy soil than sandy soil. Findings of present study are mostly agreed with the results of Sivritepe et al. (2003) and Hegazi (2015) who reported that leaf and stem length influenced by the nutritional imbalanced of various soils. Again, till per hill of fodder in both soils non-significantly differed but higher till per hill was found in sandy soil than loamy soil. Higher yield per hill was found in loamy soil (3.77 kg) than sandy soil (0.8 kg). Biomass yield also recorded significantly higher in loamy soil than sandy soil. However, results of all parameters of BLRI Napier-4 cultivar except till per hill were superior in loamy soil than that of sandy soil. Superiority performances of BLRI Napier-4 cultivar appears in loamy soil which probably due to organic matters, total N_2 and minerals compared to sandy soil. This finding was supported by Amin et al. (2016) who found similar results in Napier-4 using normal soil rather than different ratio of sandy soils. Significant different arise in length of stem and leaf of cultivated fodder which may be influenced by high water retention capacity of loamy soils compared to sandy soil.

Table 2. Effect of soil types on production performance of Napier-4 fodder at third cutting stage

Parameters	Types of soil (Mean ± SE)		P-value
	Loamy	Sandy	
Plant height (cm)	182.33 ± 15.10	110.30 ± 2.96	0.009
Stem length (cm)	122.00 ± 10.12	20.33 ± 1.20	0.001
Leaf length (cm)	116.00 ± 2.08	83.33 ± 2.40	0.001
Leaf per stem (No.)	11.67 ± 0.33	7.67 ± 0.67	0.006
Till per hill (No.)	35.67 ± 7.88	58.00 ± 16.09	0.281
Yield per hill (kg)	3.77 ± 0.84	0.80 ± 0.35	0.031
Biomass yield (Ton/acre)	39.90 ± 7.54	5.67 ± 2.32	0.023

Effect of soil types on nutritive value of Napier-4 fodder

Effect of soil types on nutritive value of BLRI Napier-4 fodder cultivar are illustrated in Table 3. Results indicated that there is no significant difference (P>0.05) existed among the nutrient content of BLRI developed Napier-4 fodder that cultivated in loamy and sandy soils. Dry matter, crude protein and ash content are almost similar in both soils. Crude fiber content was non-significantly found higher in sandy soil than loamy soil. The DM content of Napier-4 in loamy and sandy soil were 20.9 and 20.7, respectively which is similar with Rahman and Talukder (2015) who stated that DM ontent in Napier fodder is varied from 19.60 to 22.30. Crude protein of Napier-4 fodder in loamy and sandy soils were 10.76 and 11.28 %, respectively and this finding not supported by Rahman and Talukder (2015) who reported that crude protein contained 7.50-7.90% in high productive Napier varieties. Comparatively higher metabolizable energy found in loamy soil than sandy soil which is supported by Rahman and Talukder (2015) who found 9.4 to10.3 MJ/kg DM metabolizable energy in different forages.

Table 3. Nutritive value (Mean ± SE) of Napier-4 fodder in loamy and sandy soils at third cutting stage

Parameters	Loamy soil	Sandy soil	Level of significance
Fresh basis			
DM (%)	20.9±.08	20.7±0.28	NS
DM basis			
CP (%)	10.76±0.16	11.28±0.55	NS
CF (%)	12.08±0.05	15.8±0.14	NS
Ash (%)	11.59±1.00	12.01±0.35	NS
ME (MJ/kg DM)	9.12±0.5	8.85±0.48	NS

DM, dry matter; CP, crude protein; CF, crude fiber and ME, metabolizable energy. NS indicate non-significant effects on the parameters.

Conclusions

From this study, it might be concluded that production parameters of BLRI developed Napier-4 fodder influenced by soil types at third cutting stage and comparatively better productive performance found in loamy soil than sandy soil. Again, nutritive value of Napier-4 fodder did not differ significantly which indicated that soil types had no effect on nutritional composition at third cutting stage. However, farmers would be suggested to cultivate Napier-4 fodder in loamy soil at third cutting stage.

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