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Article

Effect of different soil types on growth and production of Napier-4 at the Regional Station of BLRI

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Abstract: A comparative agronomical trial was conducted to know the effect of two different soil types on growth and production performance of BLRI Napier-4 fodder production at BLRI regional station, Baghabari, Shahzadpur, Sirajganj. Soil components are the determinant factors for growing any crops or fodders. Soil samples from sandy soil and normal soil (loamy) were analazed for soil pH, nitrogen, organic matter, salinity, Ca, K, S, Zn, Pb, Co, Mg, Fe etc. at the Central Laboratory of Soil Resource Development Institute (SRDI), Dhaka. Data were recorded on plant height, stem length, leaf length, number of leaf per stem, number of till per hill, yield per hill and total biomass yield per plot. Plant height, stem length and leaf length produced in normal soil were significantly higher ($p<0.001$) than those produced in sandy soil. Irrespective of soil type, the plant height, stem length, leaf length, yield per hill and biomass yield per plot produced in second harvest were significantly higher ($p<0.001$) than those produced in first harvest. But, number of leaf per stem and number of till per hill did not differ significantly ($p>0.05$) between two cuttings. It can be concluded from the present findings that BLRI Napier-4 cultivar may be produced in the sandy soil.

Keywords: biomass yield; fodder; soil types; growth; production

1. Introduction

Availability and quality of green grasses are the major constraints of dairy cattle production in Bangladesh especially in the baghabari milk producing areas. The demand of fodder production is increasing day by day due to limited livestock feed resources in the country. The animals of our country mainly survive on the common local grasses that are not available throughout the year. On the other hand the production performance is varying according to the types of soils. The organic components of soil are the determinant factors for growing any crops or trees. Soil fertility is very much important for producing any crop which depends on different organic or inorganic components contained in soil. Texture is another important physical property of soil. Based on texture and components soils are categorized in different types like sandy, clay, loamy, silt clay, silt loam, silt clay-loam, sandy loam etc. Depending on the soil type and texture Bangladesh has divided into 30 agro-ecological zones (AEZ) named sequentially from AEZ-1 to AEZ-30 which cover all districts in Bangladesh. Though, the property of each type of soil is different, the crops and trees grown in each type of soil is different. So, it is important to determine the properties of soil as to cultivate fodder in different regions. None of the variety of fodder is suitable for all type of soil. It is essential to know the components of soil before growing any type of fodder. For this reason, BLRI is still working for the development of different high yielding fodder variety that ultimately ensures a better nutrition to our livestock. Napier grass (*Pennisetum purpureum*) is a

perennial grass grown widely as a fodder crop and feed for the cut-and-carry zero-grazing dairy systems (Bayer, 1990) and constitutes up to 80 % of forage for smallholder dairy farms (Stall *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 and a wide range of soil conditions, and high photosynthetic and water-use efficiency (Anderson *et al*., 2008). Napier grass [*Pennisetum purpureum* (Schum.)], also known as elephant grass, is a deep-rooted high yielding perennial bunch grass that is native to eastern and central Africa (Boonman, 1993). It is the most popular perennial fodder recommended for the intensively production. Considering the above points this study was conducted with a view to know the effect of different soil types on growth and production performances.

2. Materials and Methods

2.1. Site of the experiment

The experiment was conducted at the regional station, Bangladesh Livestock Research Institute (BLRI), Shahjadpur, Sirajgonj from 15 March to 6 July, 2016.

2.2. Layout of the experiment

Three plots for each treatment having homogenous soil characteristics were taken and each of the plot size was17ft×10ft. There was three replication for each treatment.

2.3. Cultivation procedure of Napier cultivars

BLRI developed high yielding Napier-4 fodders was used for this experiment. It was propagated by stem cutting method and sowed in rows. The plots were prepared by normal agronomical operations. Line to line and plant to plant distance were 70 and 30 cm, respectively. Routine weeding practices with the utensils like sickle, chen, spade etc. were done to remove undesirable grasses, bushes and plants. In each experimental plot, irrigation was performed by using a plastic pipe through a canal with the help of deep tube well in Baghabari station. Fodder was harvested at a regular interval at 40 days after each cutting, whilst first cut was made 55 days after the stem first sowed. After each cutting, land was ploughed and fertilizers were given to the soil as well as irrigation if required.

2.4. Chemical analysis

All the samples of Soils (Loamy and Sandy) and fodder were prepared and sub-samples were used for analysis. All the samples were analysed in duplicate and the mean values were recorded. Collected soil samples were analyzed for soil pH, nitrogen, organic matter, salinity, Ca, K, S, Zn, Pb, Co, Mg, Fe etc. at the Central Laboratory of Soil Resource Development Institute (SRDI), Krishi Khamar Sharak, Farmgate, Dhaka.

2.5. Data recording

During the time of harvest, records of plant height, stem length, leaf length, number of leaf per stem, number of till per hill, yield per hill and total biomass yield per plot were taken from each of the plot.

2.6. Statistical Analysis

All the recorded data were analyzed using 'SPSS' statistical program to compute analysis of variance (ANOVA) for Randomized Complete Block Design (RCBD). Differences among the treatment means was determined by Duncan′s Multiple Range Test (DMRT).

3. Results and Discussion

The analyzed results of soil composition was given in Table 1 which clearly showed the differences of soil constituents between normal (Loamy) and sandy soil. The P^H value was slightly higher in sandy soil (6.60) than that of normal (Loamy) soil (6.20). The value organic matters (OM) were found 1.75 and 0.34 percent for normal soil and sandy soil, respectively. Total Nitrogen (N_2) values were also higher in normal soil (.088%) than that of sandy soil (.017%). Except phosphorus, all other minerals were comparatively higher in normal soil than that of sandy soil which clearly indicates the sandy loam texture. The results of the present study were mostly agreed with the findings of Vishnoi et al 2010 who reported that normal soils contains higher constituents than various types of sandy soils.

Table 1. Composition of normal (Loamy soil) and sandy soil.

Soil constituents	Measuring unit	Soil type		Average value
		Normal Soil	Sandy Soil	
P^H		6.20	6.60	6.40
Organic matter (OM)	%	1.75	0.34	1.05
Total Nitrogen (N_2)	%	0.088	0.017	0.0525
Potassium (K)	Millitulanko/100 g	0.15	0.10	0.125
Calcium (Ca)	Millitulanko/100 g	8.05	0.78	4.415
Magnesium (Mg)	Millitulanko/100 g	1.49	0.39	0.94
Sodium (Na)	Millitulanko/100 g	0.15	0.11	0.13
Phosphorus (P)	Micro-gram/g	11.66	16.88	14.27
Sulphur (S)	Micro-gram/g	2.51	1.44	1.975
Boron (Bo)	Micro-gram/g	0.57	0.24	0.405
Copper (Cu)	Micro-gram/g	1.28	0.44	0.86
Iron (Fe)	Micro-gram/g	55.66	19.21	37.435
Manganese (Mn)	Micro-gram/g	4.21	0.85	2.53
Zinc (Zn)	Micro-gram/g	3.36	0.46	1.91

Table 2. Effect of soil type on production performance of BLRI Napier-4 cultivar.

Performance parameters	Measuring unit	Soil type (Mean±SE)		Overall mean (±SE)	Level of significance
		Normal	Sandy		
Plant height	Centimeter	151.1±3.60	106.6±3.60	128.8±2.55	***
Stem length	Centimeter	47.2±3.19	27.6±3.19	37.4±2.26	***
Leaf length	Centimeter	104.4±3.10	72.9±3.10	88.7±2.19	***
Leaf per stem	Number	10.4±0.65	10.8±0.65	10.6±0.46	NS
Till per hill	Number	15.4±1.02	14.4±1.02	14.9±0.72	NS
Yield per hill	Kg	3.2±0.41	3.0±0.41	3.1±0.29	NS
Biomass yield per plot	Kg	158.8±20.68	150.4±20.68	154.6±14.62	NS

*NS-p>0.05; ***-p<0.001

Table 3. Effect of cutting on production performance of BLRI Napier-4 cultivar.

Performance parameters	Measuring unit	Number of cutting (Mean±SE)		Overall mean (±SE)	Level of significance
		1st cutting	2nd cutting		
Plant height	Centimeter	96.2±3.60	161.4±3.60	128.8±2.55	***
Stem length	Centimeter	20.8±3.19	53.9±3.19	37.4±2.26	***
Leaf length	Centimeter	75.3±3.10	102.0±3.10	88.7±2.19	***
Leaf per stem	Number	10.6±0.65	10.6±0.65	10.6±0.46	NS
Till per hill	Number	14.9±1.02	14.9±1.02	14.9±0.72	NS
Yield per hill	Kg	0.8±0.41	5.4±0.41	3.1±0.29	***
Biomass yield per plot	Kg	38.3±20.68	270.8±20.68	154.6±14.62	***

*NS-p>0.05; ***-p<0.001

3.1. Production performance of BLRI Napier-4 cultivar

Table 2 illustrated the effect of soil type on production performance of BLRI Napier-4 cultivar. The results of plant height, stem length and leaf length in normal soil or loamy soil were 151.1±3.60 cm, 47.2±3.19cm and 104.4±3.10cm whereas those values were 106.6±3.60cm, 27.6±3.19cm and 88.7±2.19cm respectively in sandy soil and the difference was highly significant ($p<0.001$). But the differences in number of leaf per stem, till per hill, yield per hill and biomass yield per plot between two types soil were not significant ($p>0.05$) (Table 2). However, results of all parameters of BLRI-4 Napier cultiver excepts leaf per stem and till per hill in number were suprior in loamy soil than that of sandy soil. Superiority performances of BLRI Napier-4 cultivar that appears in loamy soil is probably due to organic matters, total N_2 and minerals compared to sandy soil wchich is poor in many of these qualities. Ruhul Amin *et al;* 2016 revealed the similar findings of plants height of BLRI Napier-4 which was 152.71±3.60 cm in normal soil rather than the different ratio of sandy soils. Significant different in length of stem and leaf of cultivated fodder may be influenced by high water retention capacity of loamy soils compared to sandy soils. 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. These findings also agreed with the results of Innocent *et al.* 2003. Mean biomass yield per hill and plot were 3.2±0.41 and 158.8±20.68 kg in loamy soil that slighty higher than sandy soil which may be the soil contents and fertilizer application to the experimental plots.

3.2. Effect of cutting number on production performance

Table 3 showed the effect of cutting on production performance of Napir-4 cultivar. Plant height, stem length and leaf length in 1st cutting were 96.2±3.60 cm, 20.8±3.19 cm, 75.3±3.10 cm, and in 2nd cutting were 161.4e±3.60 cm, 53.9±3.19 cm, 102.0±3.10 cm, respectively and these were significantly higher ($p<0.001$) than those produced in the first cut. But number of leaf per stem and number of till per hill did not differ significantly ($p>0.05$) between two cuttings (Table 3). Yield per hill and biomass yield per experimental plot were 0.8±0.41, 5.4±0.41 and 38.3±20.68, 270.8±20.68 in 1st cutting and 2nd cutting, respectively with highly significant ($p<0.001$) difference between two cuttings. The effect of cutting interval observed in this experiment was agreed with the findings of Ruhul Amin *et al*., 2016 who reported that performance parameters of fodder production like plant height, stem length, biomass yield, number of till per hill, yield per hill were significantly ($p<0.05$) varied among 1st, 2nd and 3rd cuttings respectively.

4. Conclusions

From the findings of the present experiment it was clearly observed that there was no significantly difference in the biomass yield in Normal (loamy) and Sandy soil. However, the highly significant difference were found between 1st and 2nd cuttings. Finally, it may be concluded that BLRI Napier-4 cultivar may be produced in sandy soil.

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Conflict of interest

None to declare.

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