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RESEARCH ARTICLE

Effect of Planting Materials and Sett Treatment on Establishment and Yield of Bajra Napier Hybrid Grass CO (BN) 5

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ABSTRACT

Field experiments were conducted during 2018 – 19 at Field No.53 C of Glass house farm, Department of Forage Crops, Tamil Nadu Agricultural University, Coimbatore to study the performance of single budded setts with sett treatment on establishment, growth and yield of Bajra Napier hybrid grass. Treatments comprised of single budded setts prepared by two methods of sett preparation (manual and sett cutter) and also with and without sett treatments and two methods of planting (horizontal and vertical planting) along with vertical planting of two budded setts (existing practices). Sett treatment of 12 hours soaking in water and 24 hours incubation was followed. Cumbu Napier hybrid grass variety CO (BN) 5 was used. Two trials were conducted. Significantly higher total sugar content and the lower starch content, total phenolics and lowest IAAO activity were recorded in horizontal planting of manually prepared single budded setts with sett treatment and horizontal planting of sett cutter prepared single budded setts with sett treatment. Horizontal planting of manually prepared single budded setts with sett treatment registered higher establishment of 90.8 percent, green fodder yield (121.5 t/ha/2cuts), dry matter yield (28.8 t/ha/ 2 cuts) and crude protein yield (3.90 t/ha/ 2 cuts) and it was on par with horizontal planting of sett cutter prepared single budded setts with sett treatment and vertical planting of two budded setts (existing practice). Hence, Horizontal planting of single budded setts with sett treatment (12 hours soaking in water followed by 24 hours incubation) was found to be a viable option for better establishment with reduced sett requirement (50%) and cost of cultivation.

Keywords:*Bajra Napier hybrid grass CO (BN) 5, Horizontal planting, Single budded setts, Sett treatment.*

INTRODUCTION

India holds nearly 20 percent of the world's livestock population (535.78 million) with only 2.3 percent of the world's geographical area (328.7 million ha). It ranks first in cattle (193.46 million) and buffalo population (109.85 million) and also holds the world's second largest goat (148.88 million) and third largest sheep (74.26 million) population (Livestock census, 2019). Although India possesses very bulky livestock population, the productivity of milk and other livestock products are very low when compared to other countries around the globe. Lower productivity of our livestock may be due to continuous scarcity of feeds and forages along with its poor quality, besides the genetic potential of the animals (Sivakumar et al, 2018). In India, only 4.4 percent of the cropped area (6.9 million hectares) is under fodder crops and faces 45 per cent deficit of green fodders, 21.9 per cent deficit of dry fodders and 65 percent deficit of concentrates. This gap in requirement and availability would further aggravate due to increase in livestock population (Rajesh Joladet *al.,* 2018).

In order to meet the growing demand of nutritious green fodder for livestock, it is essential to introduce high yielding fodder varieties of grasses, millets and legumes. Among the cultivated perennial grasses, Bajra Napier hybrid grass has been acclaimed as the highest forage yielder in a unit time and space. Endowed with several unique characteristics, it is well adopted to the soil and climatic conditions of India with very high productivity potential. It is one of the important fodder grasses for rearing the livestock because of its higher biomass yield as well as ultra-soft stem

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with less fibrous and sugary juice making the fodder more palatable. As the palatability is very high, the milch animals, sheep and goats relish the fodder without any wastage (Sivakumar and Vasuki, 2019). Bajra Napier hybrid grass is

propagated by the vegetative method using stem cuttings known as setts, and it is clear that planting material has considerable influence on sprouting. Thus, the selection of proper and suitable planting materials and its preparation are the most imperative factor among the various agronomic practices which requires due attention (Sriram *et al.,* 2017). At present, two budded setts are used for planting which requires high cost. Tudu et al. (2007) registered the difficulty in availability of quality setts for larger areas due to its bulkiness. According to Moraes et al. (2018), huge requirement of planting material in normal planting system leads to poor storage, loss of bud viability and high cost of cultivation. Nalawade et al. (2018) found that the germination of single budded setts with sett treatment was on par with two budded setts. Keeping these in view, field experiments were conducted to study the performance of single budded setts with sett treatment on establishment, growth and yield of Bajra Napier hybrid grass.

MATERIALANDMETHODS

Field experiments were conducted during 2018 – 19 at Field No.53 C of Glass house farm, Department of Forage Crops, Tamil Nadu Agricultural University, Coimbatore to study the performance of single budded setts on establishment, growth, yield and economics in Bajra Napier hybrid grass. Treatments includes horizontal planting of manually prepared single budded setts with sett treatment(T1), horizontal planting of manually prepared single budded setts without sett treatment(T2), horizontal planting of sett cutter prepared single budded setts with sett treatment(T3), horizontal planting of sett cutter prepared single budded setts without sett treatment(T4),vertical planting of manually prepared single budded setts with sett treatment(T5),vertical planting of manually prepared single budded setts without sett treatment(T6),vertical planting of sett cutter prepared single budded setts with sett treatment(T7),vertical planting of sett cutter prepared single budded setts without sett treatment(T8) and vertical planting of two budded setts (T9). Treatments were replicated thrice. Sett treatment of 12 hours soaking in water and 24 hours incubation under dark condition was followed. Soil of the experimental field was low in available nitrogen (181 kg ha^{-1}), medium in available phosphorus (12.4 kg ha^{-1}) and high in available potassium (396 kg ha^{-1}). Bajra Napier hybrid grass variety CO (BN) 5 was used. Two trials were conducted. The germination, establishment, growth and yield parameters were recorded. The laboratory analysis for estimating the crude protein, total sugar, starch, phenolics and auxin was done and data documented. The amount of total soluble sugars and total starch were estimated by anthrone method suggested by Hedge and Hofreiter (1962) and expressed in milligram/g of fresh weight. Total phenolics content of planting material was estimated by the method of Mallick and Singh (1980) and expressed in milligram/g of fresh weight. The IAAO activity of planting material was assayed 10 days after sprouting by the method suggested by Parthasarathy et al. (1970) using Garden-Weber reagent. The enzyme activity was expressed in µmol of unoxidised auxin/g/hr. Total nitrogen content was estimated by micro kjeldahl's method suggested by Humphries (1956) and was multiplied by the factor (6.25) to obtain the crude protein content. Crude protein content was multiplied with dry matter yield to obtain crude protein yield and expressed in t/hectare. Data on various characters studied during the course of investigation was statistically analyzed as suggested by Gomez and Gomez (1984).

RESULTSANDDISCUSSION

Total sugar content

Planting materials and sett treatment had a significant variation in bio chemical properties of Bajra Napier hybrid grass. Higher total sugar content of 61.0 mg/g was recorded in horizontal planting of manually prepared single budded setts with sett treatment (T1) and it was on par with horizontal planting of sett cutter prepared single budded setts with sett treatment (T3) and vertical planting of sett cutter prepared single budded setts with sett treatment (T7). This might be due to increased activity of enzymes viz., invertase, alpha amylase and sucrose synthase in treated setts during sprouting which involved in hydrolytic breakdown of simple sugars for its mobilization. This is in conformity with the findings of Koch, 2004. Whereas, vertical planting of manually prepared single budded setts without sett treatment (T6) was recorded the lowest total sugar content of 49.4 mg/g and it was on par with horizontal planting of sett cutter prepared single budded setts without sett treatment (T4). This is in line with the finding of Sriram et al. (2017).

Total starch content

Vertical planting of manually prepared single budded setts without sett treatment(T6) recorded higher total starch content of 31.8 mg/g and it was on par with horizontal planting of sett cutter prepared single budded setts without sett treatment (T4) and vertical planting of sett cutter prepared single budded setts without sett treatment (T8). While, the lowest starch content of 24.7 mg/g was recorded in horizontal

planting of sett cutter prepared single budded setts with sett treatment (T3) and it was on par with horizontal planting of manually prepared single budded setts with sett treatment (T1) and vertical planting of sett cutter prepared single budded setts with sett treatment (T7). Lowest starch content in setts with sett treatment might be due to increased physiological and metabolic activities when compared to setts without water soaking (Liu Yang *et al.,* 2013)..

Table 1. Effect of planting materials and sett treatment on bio chemical parameters of Napier hybrid grass CO (BN) 5 (Pooled mean of two trials)

Treatment	Total sugar (mg/g)	Total starch (mg/g)	Total phenolics (mg/g)	IAAO oxidase activity (µ mol of unoxidized auxin/g/hr)
T_1	61.0	26.3	1.62	343.20
T_2	52.2	29.9	1.83	330.40
T_3	60.8	24.7	1.51	349.80
T_4	51.9	30.7	1.90	321.00
T_5	56.7	27.4	1.65	345.40
T_6	49.4	31.8	1.96	326.20
T_7	58.4	26.5	1.58	346.25
T_8	52.3	30.2	1.93	328.40
T_9	56.3	28.8	1.74	341.15
SEd	2.4	1.3	0.07	13.60
CD (0.05)	5.0	2.7	0.15	28.20

Phenolic content

Vertical planting of manually prepared single budded setts without sett treatment(T6) recorded higher total phenolics of 1.96 mg/g and it was on par with vertical planting of sett cutter prepared single budded setts without sett treatment (T8) and horizontal planting of sett cutter prepared single budded setts without sett treatment (T4). Lowest total phenolics of 1.51 mg/g was registered in horizontal planting of sett cutter prepared single budded setts with sett treatment (T3) and it was on par with vertical planting of sett cutter prepared single budded setts with sett treatment(T7) and horizontal planting of manually prepared single budded setts with sett treatment (T1). This might be due to reduced level of phenol synthesis resulted by hydrolytic process in sett treatment. The findings of the present study are also in accordance with Miao Wang et al. (2016).

Indole Acetic Acid Oxidase Activity

Horizontal planting of sett cutter prepared single budded setts with sett treatment (T3) registered the lower IAAO activity with higher unoxidised auxin of 349.8 µmol/g/hr and it was on par with vertical planting of sett cutter prepared single budded setts with sett treatment (T7) vertical planting of manually prepared single budded setts with sett treatment (T5) and horizontal planting of manually prepared single budded setts with sett treatment (T1). Higher IAAO activity with lower unoxidised auxin of 321.0 µmol/g/hr was recorded in horizontal planting of sett cutter prepared single budded setts without sett treatment (T4) and it was on par with vertical planting of manually prepared single budded setts without sett treatment(T6) and vertical planting of sett cutter prepared single budded setts without sett treatment(T8). Increased activity of IAA oxidase significantly reduced the level of auxin in plant tissues. Lower activity of IAA oxidase in treated setts might be due to water soaking. Galston and Dalberg (1954) also noticed the reduced activity of IAA oxidase with water soaking in sugarcane.

Germination and Establishment

Germination and establishment of Bajra Napier hybrid grass were significantly influenced by planting materials and sett treatment. Horizontal planting of manually prepared single budded setts with sett treatment recorded higher germination of 92.3% and establishment of 90.8%. It was on par with horizontal planting of sett cutter prepared single budded setts with sett treatment (germination of 92.1 % and establishment of 90.9 %), vertical planting of sett cutter prepared single budded setts with sett treatment (germination of 93.0% and establishment of 84.7%), vertical planting of manually prepared single budded setts with sett treatment (germination of 90.2% and establishment of 82.9%). Lopez-Amoros et al. (2006) also reported the higher sprouting percentage setts due to higher availability of the reducing sugars along with sprouting inducing hormones and enzymes. However, the lowest germination percentage of 77.2 was recorded in horizontal planting of sett cutter prepared single budded setts without sett treatment and lowest establishment percentage of 71.8 was recorded in vertical planting of sett cutter prepared single budded setts without sett treatment. Comparatively low levels of α, β-amylase and sucrose synthase with increased level of phenolics and IAAO activity in un treated setts might be the reason for reduced conversion of starch into reduced sugars, amino acids and other products in growing embryo, which resulted in reduced sprouting and establishment (Tarpley *et al.,* 1994).

Yield of Bajra Napier hybrid grass

Planting materials and sett treatment had a significant impact on green fodder yield, dry matter yield and crude protein yield of Bajra Napier hybrid grass. Horizontal planting of manually prepared single budded setts with sett treatment recorded the highest green fodder yield (121.5 t/ha/2cuts), dry matter yield (28.8 t/ha/ 2 cuts) and crude protein yield (3.90 t/ha/ 2 cuts). It was on par with horizontal planting of sett cutter prepared single budded setts with sett treatment

which recorded the green fodder yield of 114.2 t/ha/ 2 cuts, dry matter yield of 27.1 t/ha/2 cuts and crude protein yield of 3.66 /ha/ 2cuts and vertical planting of two budded setts (existing practice). The highest green fodder yield and dry matter accumulation in single budded setts with sett treatment might also be associated with well-developed root system resulted by

low level of growth inhibitors like phenolics and high level of growth promoters like auxin. It favours the efficient absorption of moisture and nutrients from the soil and in turn induced the profuse vegetative growth. Similar views have also been expressed by Nithya et al. (2017). Vertical planting of sett cutter prepared single budded setts without sett treatment recorded lower green fodder yield (94.8 t/ha/2cuts), dry matter yield (22.5 t/ha/ 2 cuts) and crude protein yield (3.04 t/ha/ 2 cuts). It might be due to lower sprouting, lack of vigour along with reduced efficiency in harnessing the photosynthetic radiation for better growth and development. Sriram et al. (2017) also expressed the similar views.

Table 2. Effect of planting materials and sett treatment on germination establishment, yield and quality of Bajra Napier hybrid grass CO (BN) 5 (Pooled mean of two trials)

Treatment	Germination (%)	Establishment (%)	Green fodder yield (t/ha/2cuts)	Dry matter yield (t/ha/2cuts)	Crude protein yield (t/ha/2cuts)
T_1	92.3	90.8	121.5	28.8	3.90
T_2	80.4	79.3	105.7	25.0	3.39
T_3	92.1	90.9	114.2	27.1	3.66
T_4	77.2	74.9	101.7	24.1	3.27
T_5	90.2	82.9	102.6	24.3	3.29
T_6	81.6	76.3	96.1	22.7	3.08
T_7	93.0	84.7	103.7	24.5	3.33
T_8	83.5	71.8	94.8	22.5	3.04
T_9	94.4	90.1	108.6	25.7	3.48
SEd	4.10	3.89	4.34	1.10	0.18
CD (0.05)	8.50	8.15	9.10	2.27	0.26

CONCLUSION

It could be concluded that horizontal planting of single budded setts with sett treatment registered higher establishment and green fodder due to the changes in biochemical properties and hence, it was found to be a viable option for reducing half of the sett requirement and cost of cultivation.

Ethics statement

No specific permits were required for the described field studies because no human or animal subjects were involved in this research.

Originality and plagiarism

We ensure that we have written and submit only entirely original works with no plagiarism

Consent for publication

All the authors agreed to publish the content.

Competing interests

There were no conflict of interest in the publication of this content

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