Research Article

Biochemical Changes of Planting Material and Its Impacts on Sprouting and Establishment of Bajra Napier Hybrid Grass Co (Bn) 5

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Abstract

Experiment was conducted at Tamil Nadu Agricultural University, New Area Farm, Coimbatore during September, 2016 – December, 2016 to evaluate different age and portion of planting materials on biochemical changes and its impacts on sprouting of bajra napier hybrid grass CO(BN) 5. The experiment was laid out in split plot design with three replications. The treatments comprised of the top portion (M_1), middle portion (M_2) and bottom portion (M_2) of setts in main plots and four different ages of the setts *viz.*, three months (S_1), four months(S_2), five months(S_3) and six months(S_4) aged setts, respectively in sub plots. Initial planting material analysis revealed that top portion recorded higher total sugar, lower starch and total phenolics with reduced Indole-3-acetic acid oxidase (IAAO) activity and it was on par with middle portion. In case of age of setts, four months old setts recorded higher total sugar, lower starch and total phenolics with reduced Indole-3-acetic acid oxidase (IAAO) activity. Interaction between age and portion of setts, showed that top portion of three months old setts was found to be superior in recording the biochemical parameters. Higher sprouting and establishment were noticed in middle portion and the lowest sprouting and establishment were recorded in bottom portion. Regarding the age of setts, four months old setts registered significantly higher sprouting and establishment, which was on par with five months old setts. Interaction between portion and age of setts, middle portion of four months old setts registered higher sprouting and establishment.

Keywords: Bajra napier hybrid grass, planting materials, portion, age, biochemical changes, sprouting, establishment

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Introduction

India has very large population of livestock, although the productivity of milk and other livestock products are very low when compared to other countries around the world. Low productivity of our livestock can be attributed by factors such as malnutrition, under-nutrition or both, besides the genetic potential of the animals. In these circumstances, cultivation of nutritious and high yielding fodder will pave the way for enhancing farm animals' productivity and profitability in a sustained manner. Among the cultivated perennial grasses, bajra napier hybrid grass has been acclaimed as the highest forage yielder in a unit time and space among the cultivated perennial grasses. It has gained considerable importance in dairy industry because of its quick sprouting and rejuvenating capacity. It is considered as cut and carry forage for all stall feeding systems compared to other fodder crops. It is propagated commercially by the vegetative method using stem cuttings known as setts. Thus, the selection of appropriate planting material is the most important factor among the various agronomic practices.

The work on effect of use of different age and portion of planting material on biochemical changes of bajra napier hybrid grass is very meagre under Indian condition. Hence, there is a need to evaluate the biochemical changes of different planting materials viz., top, middle and bottom portion setts from three, four, five and six months old clumps of bajra napier hybrid grass for better sprouting and field establishment. Therefore, the experiment was initiated with the objective of evaluating the effect of age and portion of planting material and its impacts on biochemical changes of bajra napier hybrid grass.

Materials and Methods

The field experiment was conducted in the F Block of New Area Farm, Department of Forage Crops, Tamil Nadu Agricultural University, Coimbatore. The farm is situated in the north western agro climatic zone of Tamil Nadu at 11^0North latitude, 77^0 East longitude and at an altitude of 426.7 meters above mean sea level. The area has a mean maximum temperature of 31.8^0C and a mean minimum temperature of 21.7^0C. The soil of the experimental field was sandy clay

loam in texture. The chemical analysis indicated that the soil was medium in available nitrogen (280 Kg/ha), high in available phosphorus (29.12 Kg/ha) and high in available potassium (841.0 Kg/ha).

The experiment was laid out in split plot design with three replications. The treatments comprised of different age and portion of planting materials. In main plot three levels of stem portions *viz.,* top, middle and bottom and in sub plot four age levels setts *viz.,* three, four, five and six months were assigned. Thus, there were twelve treatment combinations replicated three times. The standard analytical methods were used for biochemical analysis *viz.,* total sugars and total starch (mg/g) were estimated through Hedge and Hofreiter (1962) [1], total phenolics (mg/g) by Mallick and Singh (1980) [2] and IAAO activity (µmol of unoxidised auxin/g/hr) was estimated by Parthasarathy *et al*. (1970) [3].

Result and Discussion

Total sugars

Portion and age of the bajra napier hybrid grass setts had a significant impact on total sugar content of the setts (**Table 1**). Regarding the portion of setts, top portion of setts registered higher total sugar content of 51.92 mg/g which was followed by middle portion (44.00 mg/g). Bottom portion recorded the lowest total sugar content of 36.73 mg/g. This is in line with the findings of Vaidhyanadhan Subramanian *et al.* (1987) [4]. Among the age of setts, three months old setts recorded higher total sugar content (51.97 mg/g) and it was followed by four months old setts (47.68 mg/g). The lowest total sugar content of 35.57 mg/g was recorded in six months old setts.

Interaction between portion and age of setts revealed that top portion of three months old setts registered maximum total sugar content of 58.92 mg/g which was followed by top portion of four months old setts (53.35 mg/g). Bottom portion of six months old setts recorded the lowest total sugar content of 28.96 mg/g.

Table 1 Effect of age and portion of planting materials on biochemical parameters

Treatments	Total sugars (mg/g)	Total starch (mg/g)	Total phenolics (mg/g)	IAAO activity (µmol of unoxidised auxin/g/hr)
Main Plot : Portion Of Setts				
M_1 – Top portion	51.92	29.53	1.87	341.5
M_2 – Middle portion	44.00	36.31	2.73	322.6
M_3 – Bottom portion	36.73	51.42	3.81	307.5
SEd	0.70	0.23	0.04	4.69
CD (P = 0.05)	1.95	0.64	0.10	13.04
Sub Plot : Age Of Setts				
S_1 – Three months	51.97	24.99	1.89	340.4
S_2 – Four months	47.68	34.86	2.42	330.6
S_3 – Five months	41.66	44.88	2.97	320.1
S_4 – Six months	35.57	51.63	3.94	304.5
SEd	1.14	1.21	0.09	8.75
CD (P = 0.05)	2.41	2.55	0.20	18.39

Total Starch

Plant non-structural carbohydrate comprised of starch and sugars is a product of carbon assimilation that can be stored and used to meet the future demands for growth and metabolism [5]. Higher starch was accumulated in bottom portion of the setts when compared to the middle portion and top potion of the setts. Study conducted by Wood (1962) [6] also confirmed that lower half of the cane stalk contained higher starch content than the upper half. Among the age of setts, starch content was higher in six months old setts and lower in three months old setts. In case of interaction, bottom portion of six months old setts registered highest starch content whereas, top portion of three months old setts recorded the lowest total sugar content. This might be due the accumulation of fixed carbon as starch in amyloplasts, the storage sinks.

Total phenolics

The results of the present investigation showed that total phenolics content was higher in bottom portion of setts (3.81 mg/g) and lower in top portion of setts (1.87 mg/g). This is in confirmity with the study conducted by Manohar *et al.* (2014) [7] that the bottom portion of the stem was found to have higher phenolics content when compared to other

portions in sugarcane. In case of age of setts, the maximum total phenolics content was registered in six months old setts, followed by five months old setts and the minimum total phenolics content was observed in three months old setts. In interaction between portion and age of setts, also showed that bottom portion of six months aged setts recorded significantly higher total phenolics content (4.71 mg/g) than the top portion of three months aged setts (1.30mg/g). The findings of the present study are also in accordance with Miao Wang *et al.* (2016) [8].

Indole-3-acetic acid (IAA) oxidase activity

The auxin levels and apical dominance are determined by the IAA oxidase activity. Increased activity of IAA oxidase significantly reduced the level of auxin in plant tissues. The present analysis of IAA oxidase activity in sprouted buds of planting materials at ten days after sprouting indicated that significant increase in enzyme activity of bottom portion with low value of 307.5 µmol of unoxidised auxin/g/hr. Among age of setts, lower unoxidised auxin was recorded in six months aged setts (304.5 µmol of unoxidised auxin/g/hr). Unoxidized auxin decreased at bottom portions and aged setts due to higher IAA oxidase activity. IAA oxidase activity was low in the region of high auxin content and high in the region of low auxin content [9]. In interaction between portion and age of setts, there was no significant effect on IAAO activity.

Sprouting and Establishment

Plant population at an optimum level is essential for achieving potential yield of any crop. Yield losses associated with plant population of the crops are continued to the subsequent ratoons. Hence, utmost care must be taken on sprouting and establishment for maintaining adequate plant population especially in perennial crops (**Table 2**).

Table 2 Effect of age and portion of planting materials on sprouting and establishment

Treatments	Sprouting %	Establishment %
Main Plot : Portion Of Setts		
M1 – Top portion	63.92 (80.31)	62.83 (77.69)
M2 – Middle portion	65.49 (81.66)	67.06 (83.48)
M3 – Bottom portion	61.34 (76.30)	61.91 (77.00)
SEd	00.99	1.17
CD (P=0.05)	2.76	3.25
Sub Plot : Age Of Setts		
S1 – Three months	60.83 (76.15)	57.19 (70.12)
S2 – Four months	71.52 (89.47)	72.80 (90.58)
S3 – Five months	63.66 (79.89)	66.29 (83.06)
S4 – Six months	58.32 (72.20)	59.44 (73.79)
SEd	1.58	1.88
CD (P=0.05)	3.33	3.96

Arcsine transformation was carried out. Figures in the parenthesis are original values

Among the different portion of setts, middle portion recorded higher sprouting and establishment which was comparable with top portion. The lower sprouting and establishment were recorded in bottom portion. Lopez-Amoros *et al*. (2006) [10] also reported the higher sprouting percentage in upper portion of the stem due to higher availability of the reducing sugars which serve as readily available food reserve for quick sprouting. In addition, sprouting inducing hormones and enzymes in upper portion found to be not affected by lesser amount of phenolic compounds along with reduced activity of IAA oxidase. In case of age of setts, higher sprouting and establishment were recorded in four months old setts which were followed by five months old setts. The lower sprouting and establishment were recorded in three months old setts and it was on par with six months old setts. The presence of young buds with very active primordial cells, which contain enzymes that are easily activated under favourable environmental conditions, could be the reason for higher sprouting and establishment in four months old setts. During sprouting, α-Amylase enzyme hydrolyzes the starch chains internally to produce oligosaccharides consisting of α-1,4-linked glucose residues. β-amylase enzyme degrades these oligosaccharides from the ends to produce maltose, a disaccharide finally to glucose. In the mature tissue, the low levels of α, β-amylase and sucrose synthase by increased level of phenolics and IAAO activity 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 growth in six months aged setts [11]. Lower sprouting was also observed in three months old younger setts. This was attributed due to less food reserves and

limited moisture content which depletes at faster rate and emanated the higher temperature especially in sprouting buds [12].

From the results, it was found that middle portion of four months old setts recorded higher sprouting and establishment which was comparable with bottom portion of four months aged setts. The lower sprouting and establishment was recorded in top portion of three months aged setts and it was on par with bottom portion of six months old setts. The current finding concurs with the findings of Yeshimebet *et al.* (2009) [13]. The lower sprouting and establishment could be attributed due to loss of tenderness, drying up of covering scales and internal changes like accumulation of growth inhibitors [14].

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Publication History
Received 06th Dec 2017
Revised 18th Dec 2017
Accepted 20th Dec 2017
Online 30th Dec 2017