Electronic Journal of Plant Breeding, 5(2): 220-229 (June 2014)
ISSN 0975-928X

Research Article

High green fodder yielding new grass varieties

C. Babu, K. Iyanar and A. Kalamani
Department of Forage Crops, Tamil Nadu Agricultural University, Coimbatore 641 003, Tamil Nadu.

(Received: 06 Mar 2014; Accepted:19 Apr 2014)

Abstract
Two high biomass yielding forage grass varieties one each in Cumbu Napier hybrid and Guinea grass have been evolved at the Department of Forage Crops, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore and identified for release at national (All India) level as Cumbu Napier hybrid grass CO (BN) 5 and Guinea grass CO (GG) 3 during 2012 and 2013 respectively. Cumbu Napier hybrid grass CO (BN) 5 secured first rank at all national level with reference to green fodder yield (2010), dry matter yield (2009 and 2010), crude protein yield (2011) and crude protein per cent (2010) while Guinea grass CO (GG) 3 ranked first at All India level for green fodder yield in 2010, 2011 and 2012, dry matter yield in 2010, 2011 and 2012 and crude protein yield in 2010, 2011 and 2012. Cumbu Napier hybrid grass CO (BN) 5 had recorded significantly higher mean green fodder yield (GFY) of 1082 q/ha/year, dry matter yield (DMY) of 239.03 q/ha/yr and crude protein yield (CPY) of 18.32 q/ha/yr in AICRP on Forage crops trials over the qualifying and national check varieties. Similarly, Guinea grass CO (GG) 3 too registered a higher mean GFY, DMY and CPY of 1082.4, 229.3 and 20.5 q/ha/year respectively over the qualifying and national check varieties.

Key words: Cumbu Napier hybrid, Guinea grass, green fodder, dry matter

Introduction

High yielding nutritious green fodders are the basic input for affluent milk production in milch animals. India is the world's largest single milk producer, with a total of 117 million tonnes of liquid milk produced in 2010 (www.nddb.coop). Dairy production is also the most important agricultural activity in the country, contributing about 5.3 per cent to the agricultural gross domestic product. While in India the average yield per dairy cow per year is estimated to be 1,284 kg of liquid milk, the figure is 6,212 kg in the European Union and 9,117 kg in the United States (www.faostat.fao.org). This low productivity is attributed to inadequate supplies of quality feeds and fodder, gradual genetic deterioration and the general neglect of animals over the centuries leading to rise in the population of nondescript cows and buffaloes.

Due to ever-increasing population pressure of human beings, arable land is mainly used for food and cash crops, thus there is little chance of having good-quality arable land available for fodder production, unless milk production becomes remunerative to the farmer as compared to other crops. To meet the current level of livestock production and its annual growth in population, cultivation of perennial fodder varieties which can yield higher biomass per unit area is the immediate solution.

With these objectives, breeding work was commenced at Department of Forage Crops, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore. As a result two high yielding nutritious forage grass varieties one each in Cumbu Napier hybrid grass and Guinea grass *viz*., CO (BN) 5 and CO (GG) 3 have been identified for release at National (All India) level during 2012 and 2013 respectively. The Guinea grass variety CO (GG) 3 has already been released at state level during 2009. The performance and salient features of the new varieties in comparison with the qualifying and National check varieties are presented hereunder.

Material and Methods

Cumbu Napier hybrid grass CO (BN) 5:

It is an interspecific hybrid between Fodder Cumbu IP 20594 (*Pennisetum glaucum*) and Napier grass FD 437 (*P. purpureum Schumach*). The cross was made during the year 2005. Promising clones possessing desirable characters which contribute towards high biomass, high leaf stem ratio and succulent stem were selected from F_1 generation. These clones were evaluated for their sustained performance and as a result an elite clone TNCN 074 was identified. The clone TNCN 074 was evaluated with the check CO 3 at Forage Research Farm, Coimbatore from 2007 to 2009. The clone TNCN 074 along with three other promising clones *viz*., TNCN 071, TNCN 072 and TNCN 073 have been sponsored to AICRP on Forage crops for conducting All India Coordinated varietal trial from 2008. The clones have been multiplied and established in 2008 with three replications in RBD design and regular biometric observations have been recorded from 2009 to 2011.

Guinea grass CO (GG) 3

Guinea grass variety CO (GG) 3 is a clonal selection from Mumbasa which is an exotic collection from Africa. The clone Mumbasa is characterized by robust growth with more number of longer and broader leaves contributing towards high green fodder yield. The leaves and stems of the clone Mumbasa were possessed with spines and hairs, which are not preferred by the livestock. Hence, clonal selection was made from the original Mumbasa and as a result, a promising clone TNGG 062 possessed with desirable characters such as high biomass with glabrous stems and leaves and more leaf stem ratio was selected and subjected to continuous evaluation along with CO 2 from 2007 to 2009 at Forage Research Farm, Coimbatore. Owing to its superior performance, it was nominated to AICRP on Forage crops for conducting All India Coordinated varietal trial from 2009. The clones have been multiplied and established in 2009 with three replications in RBD design and routine biometric observations have been recorded as per technical programme of AICRP on forage crops from 2010 to 2012.

Results and Discussion

Cumbu Napier hybrid grass CO (BN) 5

The yield data obtained from research station trials showed that, TNCN 074 recorded (Table 1) higher fodder yield (3260 q/ha/yr) than the check CO 3 (2960 q/ha/yr). It had registered a mean green fodder yield of 1082 q/ha/year in All India Co-ordinated Varietal Trials tested over three years at 16 locations with 0.05%, 4.2%, 43.3%, 6.9% and 5.8% increased fodder yield over the Qualifying and National check varieties BNH 3, BNH 10**,** NB-21, CO 3 and PNB-233 respectively (Table 3). It was superior in terms of dry matter yield with 239.03q/ha/yr which was 4.92, 38.54, 7.43 and 5.02 per cent increase over the qualifying and check varieties BNH 10, NB 21, CO 3 and PNB-233 respectively (Table 3). The per day productivity of green fodder yield (GFY) in CO (BN) 5, which is a significant factor that ascertains the uninterrupted supply of required green fodder was also higher with 4.04, 20.26, 11.30 and 13.48 per cent increase over BNH 3 and the other three checks respectively.

Further the crude protein yield of CO (BN) 5 was found to be higher with 18.32 q/ha/yr in All India Co-ordinated Trials evaluated over three years in 11 locations. The per cent increase over the qualifying entries and checks *viz*., BNH 3, BNH 10, NB 21, CO 3 and PNB-233 was 9.9, 3.9, 19.7, 6.7 and 6.1 respectively. It had secured first rank at all National level with reference to green fodder yield (2010), dry matter yield (2009 and 2010), crude protein yield (2011) and crude protein per cent (2010).

The stem is ultra soft, less fibrous with sugary juice, making the fodder more palatable. The tillers are numerous and they grow faster. It has larger and softer leaves with glabrous leaf sheaths and blades. The leaf-stem ratio is higher. As the palatability is very high, the milch animals, sheep and goats relish the fodder without wastage (Table 9). The establishment rate of CO (BN) 5 was 100 % in almost all the centers when compared to other checks and test entries which is an important and desirable feature as far as perennial crop is concerned.

Guinea grass CO (GG) 3

The results obtained from research station trials revealed that, TNGG 062 recorded (Table 2) consistently higher fodder yield (3594 q/ha/yr) than the check CO 2 (2715.5 q/ha/yr). It had registered a mean green fodder yield of 1082.4 q/ha/year in All India Co-ordinated Varietal Trials tested over three years at 11 locations with 2.7 %**,** 35.8 %**,** 37.5 %**,** 63.3 % and 58.9 % increased fodder yield over the qualifying and national check varieties RSD GG-1, JHGG 09-01, Riversdale, PGG-616 and Bund Guinea-1 respectively (Table 4). It was superior in terms of dry matter yield with 229.3 q/ha/yr which was 3.6, 28.2, 35.2, 50.1 and 46.9 per cent increase over the qualifying and check varieties *viz*., RSD GG-1, JHGG 09-01, Riversdale, PGG-616 and Bund Guinea-1 respectively (Table 4). The per day productivity of GFY in CO (GG) 3, which is an important factor that ensures the continuous supply of required green fodder was also higher with 12.1, 37.0, 42.3, 54.2 and 85.0 per cent increase over qualifying and check varieties respectively.

Further the crude protein yield of CO (GG) 3 was found to be exceedingly higher with 20.5 q/ha/yr. The percentage increase over the qualifying entries and checks *viz*., RSD GG-1, JHGG 09-01, Riversdale, PGG-616 and Bund Guinea-1 was 10.2, 20.6, 39.5, 43.4 and 26.5 respectively. It surpassed the qualifying entries and check varieties and ranked first at All India Level for green fodder yield in 2010, 2011 and 2012, dry matter yield in 2010, 2011 and 2012 and Crude protein yield in 2010, 2011 and 2012.

The tillers are numerous and they grow faster. It has larger and softer leaves with glabrous leaf sheaths and blades. The leaf-stem ratio is higher. As the palatability is very high, the milch animals, sheep and goats relish the fodder without wastage (Table 10). Considering the supremacy of the clones TNCN 074 and TNGG 062 over their respective National checks and qualifying entries, they were identified for National release at All India level as Cumbu Napier hybrid grass CO (BN) 5 and Guinea grass CO (GG) 3 during 2012 and 2013 respectively.

References:

FAO. 2010. A global perspective.

Annual Report Kharif .2012. AICRP on Forage Crops, IGFRI, Jhansi

Annual Report Kharif 2013. AICRP on Forage Crops, IGFRI, Jhansi

FAOSTAT database, Production–Livestock Primary retrieved from http://www.faostat.fao.org.

Hemme, T. and Otte, J. 2010. Status of and prospects for smallholder milk production

National Institute of Rural Development, Study on the improvement in rural livelihoods through dairy farming, retrieved from http://www.nird.org.in/.

Table 1. Green fodder yield of Cumbu Napier hybrid grass TNCN 074 in Research Station Trials (2007-08 and 2008-09)

No. of cuts (Average of two years)	Green fodder yield (q/ha/yr)	
	TNCN 074	CO 3
I	550.0	500.0
II	507.0	470.0
III	490.0	460.0
IV	515.0	480.0
V	420.0	380.0
VI	398.0	350.0
VII	380.0	320.0
Average Green fodder yield (7 cuts) of 2007-08 and 2008-09	3260.0	2960.0
% increase over the check CO 3		10.14

Table 2. Green fodder yield of Guinea grass TNGG 062 in Research Station Trials (2007-08 and 2008-09)

No. of cuts (Average of two years)	**Green fodder yield (q/ha/yr)**	
	TNGG 062	**CO 2**
I	541.0	440.0
II	520.0	362.0
III	470.0	376.0
IV	475.5	403.5
V	518.5	361.5
VI	600.5	392.5
VII	468.5	380.0
Average Green fodder yield (7 cuts) of 2007-08 and 2008-09	**3594.0**	**2715.5**
% increase over the check CO 2		**32.4**

Table 3. Summary for GFY (q/ha) and DMY (q/ha) of Cumbu Napier hybrid CO (BN) 5 under coordinated trials of AICRP (FC)

Particulars	Year	No. of trials	Variety	Qualifying varieties		Checks		
			CO (BN) 5	BNH 3	BNH 10	NB 21	CO 3	PNB 233
	2009	13	999.8	1024.6	929.5	787.4	1009.8	1017.9
Mean GFY (q/ha/yr)	2010	16	1130.0	1061.7	1068.4	819.3	1083.2	1038.6
	2011	16	1115.7	1157.7	1116.8	658.3	941.7	1011.2
Grand mean			**1081.8**	**1081.3**	**1038.2**	**755.0**	**1011.6**	**1022.6**
% increase over the Grand mean				**0.05**	**4.20**	**43.29**	**6.95**	**5.80**
	2009		**4**	1	7	12	3	2
All India rank	2010		**1**	4	3	12	2	5
	2011		**3**	1	2	12	10	5
	2009	13	226.7	224.8	198.3	182.8	215.1	218.5
Mean DMY (q/ha/yr)	2010	16	242.6	225.7	232.8	175.2	235.1	227.2
	2011	16	247.8	268.1	252.4	159.6	217.3	237.1
Grand mean			**239.0**	**239.5**	**227.8**	**172.5**	**222.5**	**227.6**
% increase over the Grand mean				**-0.21**	**4.92**	**38.54**	**7.43**	**5.02**
	2009		**1**	2	8	10	5	3
All India rank	2010		**1**	5	3	12	2	4
	2011		**3**	1	2	12	10	4

Table 4. crude protein percentage and Crude protein yield under coordinated trials of AICRP (FC)

Name of the trial	No. of locations	Crude protein (%)				Crude protein yield (q/ha/yr)				Per day Productivity (GFY)			
		TNCN 074	NB 21	CO 3	PNB 233	TNCN 074	NB 21	CO 3	PNB 233	TNCN 074	NB 21	CO 3	PNB 233
VT BxN Hybrid – 2009	8	7.4	7.1	8.1	7.6	16.7	15.6	16.4	16.7	4.41	3.05	3.37	3.58
VT BxN Hybrid – 2010	11	8.4	7.8	7.9	8.3	18.2	14.8	18.5	17.2	5.68	5.53	6.15	5.25
VT BxN Hybrid – 2011	11	9.4	10.4	9.2	9.1	20.05	15.5	16.5	17.9	3.79	2.96	2.97	3.42
Total of three years		25.2	25.3	25.2	25.0	54.95	45.90	51.40	51.80	13.88	11.54	12.49	12.25
Average of three years		**8.4**	**8.4**	**8.4**	**8.3**	**18.32**	**15.30**	**17.13**	**17.27**	**4.63**	**3.85**	**4.16**	**4.08**
% increase over the check varieties		**-**	**-**	**-**	**1.20**		**10.90**				**15.00**		

Table 5. Summary for GFY (q/ha) and DMY (q/ha) of Guinea grass CO (GG) 3 under co ordinated trials of AICRP (FC)

Particulars	Year	No. of trials	Variety	Qualifying varieties		Checks		
			CO (GG) 3	RSD GG-1	JHGG 09-01	Rivers dale	PGG-616	Bund Guinea-1
	2010	11	1046.9	1004.1	745.2	763.3	661.0	620.8
Mean GFY (q/ha/yr)	2011	11	1093.6	1066.3	839.1	771.5	640.2	718.6
	2012	10	1106.8	1091.7	807.4	826.7	687.8	704.2
Grand mean			**1082.4**	**1054.0**	**797.2**	**787.2**	**663.0**	**681.2**
% increase over the Grand mean				**2.7**	**35.8**	**37.5**	**63.3**	**58.9**
	2010		**1**	2	4	3	6	7
All India rank	2011		**1**	2	3	5	7	6
	2012		**1**	2	4	3	7	6
	2010	11	202.7	197.9	159.1	158.9	144.7	127.7
Mean DMY (q/ha/yr)	2011	11	225.3	216.8	181.1	161.6	143.5	158.3
	2012	10	259.9	249.3	196.5	188.3	170.3	182.3
Grand mean			**229.3**	**221.3**	**178.9**	**169.6**	**152.8**	**156.1**
% increase over the Grand mean				**3.6**	**28.2**	**35.2**	**50.1**	**46.9**
	2010		**1**	2	3	4	5	7
All India rank	2011		**1**	2	3	5	7	6
	2012		**1**	2	3	4	7	6

Table 6. Per day green fodder yield of Guinea grass - CO (GG) 3

Name of the trial	No. of trials	GFY (q/ha/day)					
		TNGG 062	RSD GG-1	JHGG 09-01	Rivers dale	PGG-616	Bund Guinea-1
VT GG - 2010	04	3.76	3.45	2.89	2.90	2.62	2.05
VT GG - 2011	05	3.56	3.10	2.68	2.44	2.35	1.93
VT GG - 2012	06	3.67	3.49	2.49	2.49	2.09	1.91
Total of three years		11.0	10.0	8.1	7.8	7.1	5.9
Average of three years		3.7	3.3	2.7	2.6	2.4	2.0
% increase over the qualifying and check varieties			12.1	37.0	42.3	54.2	85.0

Table 7. Mean Crude protein yield of Guinea grass - CO (GG) 3 (q/ha/yr)

Name of the trial	**No. of trials**	**Crude protein yield**					
		TNGG 062	**RSD GG-1**	**JHGG 09-01**	**Rivers dale**	**PGG-616**	**Bund Guinea-1**
VT GG - 2010	07	15.4	14.6	13.6	13.3	12.5	11.6
VT GG - 2011	07	18.2	17.1	16.3	14.0	13.9	15.6
VT GG - 2012	06	28.0	24.0	21.2	16.9	16.5	21.5
Total of three years		61.6	55.7	51.1	44.2	42.9	48.7
Average of three years		**20.5**	**18.6**	**17.0**	**14.7**	**14.3**	**16.2**
% increase over the qualifying and check varieties			**10.2**	**20.6**	**39.5**	**43.4**	**26.5**

Table 8. Mean Crude protein (%) of Guinea grass - CO (GG) 3

Name of the trial	No. of trials	Crude protein (%)					
		TNGG 062	RSD GG-1	JHGG 09-01	Rivers dale	PGG-616	Bund Guinea-1
VT Guinea grass - 2010	6	7.7	7.5	7.6	7.7	8.0	8.3
VT Guinea grass - 2011	6	7.0	7.0	7.0	7.3	7.7	7.6
VT Guinea grass - 2012	5	7.8	7.7	7.5	7.9	8.0	8.1
Total of three years		22.5	22.2	22.1	22.9	23.7	24.0
Average of three years		7.5	7.4	7.4	7.6	7.9	8.0
% increase over the qualifying and check varieties			1.4	1.4	-1.3	-5.1	-6.3

Table 9. General botanical description of Cumbu Napier hybrid grass CO (BN) 5

Name of the variety	Cumbu Napier hybrid grass CO (BN) 5
Common name	Cumbu Napier hybrid
Botanical name	Interspecific hybrid between Fodder Cumbu IP 20594 (*Pennisetum glaucum*) and Napier grass FD 437 (*P. purpureum Schumach*).
Family status	Poaceae
Growth habit	Robust Tillering perennial grass
Foliage	High leafy (400-430 leaves/clump); long and broad leaves (100-110 cm long and 4.0-5.0 cm width). Leaf colour: Medium green Shape: Lanceolate Texture: Soft Leaf sheath: Glabrous Leaf margin: Slightly serrated
Flower colour	Light yellow
Days to 50% flowering	Does not arise
Days to 50% maturity	Does not arise
Days to maturity	First cut on 75-80 days after planting and subsequent cuttings at 45 days interval. Being perennial, can remain in the field for 3-4 years.
Panicle colour	Light yellow
Inflorescence length	20-25 cm (Bristled)
Number of seeds/ spikelet	Does not arise since propagated through stem cuttings/ rooted slips
1000-seed weight	Does not arise because of triploid nature
Seed colour	Does not arise
Seed shape and size	Does not arise
Green forage yield	1082 q/ha /year
Dry matter yield	239 q/ha /year

Table 10.General botanical description of Guinea grass CO (GG) 3

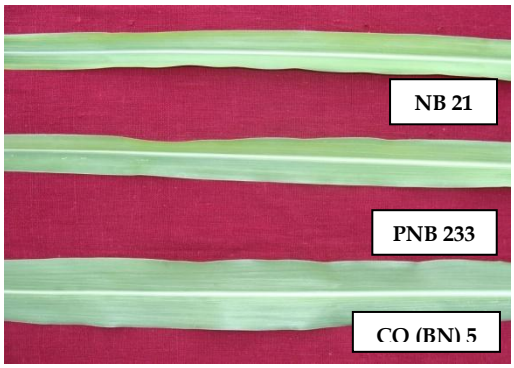
Name of the variety	Guinea grass CO (GG) 3
Common name	Guinea grass
Botanical name	*Panicum maximum* Jacq
Family status	Poaceae
Growth habit	Robust Tillering perennial grass
Foliage	High leafy (250 – 300 leaves/clump); long and broad leaves (90-100 cm long and 3.0-4.0 cm width). Leaf colour: Light green Shape: Lanceolate Texture: Soft Leaf sheath: Light green, Hairy junction Leaf margin: Slightly serrated
Flower colour	Light greenish yellow
Days to 50% flowering	60 - 70 days when days are shorter; Shy flowering in nature
Days to 50% maturity	Does not arise
Days to maturity	First cut on 75-80 days after planting and subsequent cuttings at 45 days interval. Being perennial, can remain in the field for 3-4 years.
Panicle colour	Light green
Inflorescence length	60-75 cm
Number of seeds/ spikelet	One
1000-seed weight	1.5 – 2.0 g.
Seed colour	Cream
Seed shape and size	Ovate; small and bold
Green forage yield	1082.4 q/ha /year
Dry matter yield	229.3 q/ha /year

Plate 1. Morphological features of CO (BN) 5

Luxurious growth of CO (BN) 5

Erect and non lodging habit of CO (BN) 5

Plumby clump of CO (BN) 5



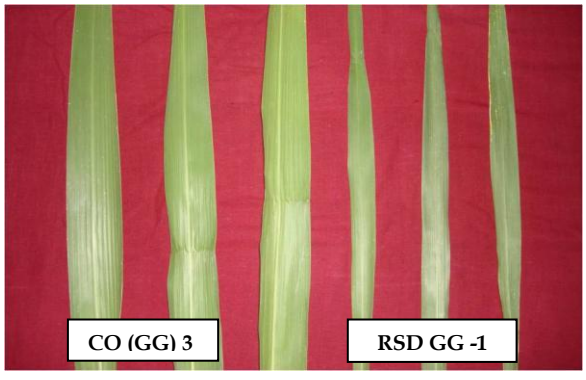
Long, broad and soft leaves of CO (BN) 5

Plate 2. Morphological features of CO (GG) 3

Luxurious growth of CO (GG) 3

Tolerant to shade; suited for coconut groves

Exuberant tillering nature of CO (GG) 3



Long, broad and soft leaves of CO (GG) 3