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Research Article

# A new high yielding black *kolukattai* grass variety CO 2 (*Cenchrus setigerus*) suitable for Pasture lands

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**Abstract**

*Cenchrus setigerus* is commonly known as black *kolukkattai grass and is a* herbaceous perennial pasture land grass. TNCS 265 is a *selection from* Kangayam local developed at Department of Forage Crops, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore. TNCS 265 had registered high biomass yield in Station Trials (38.9 t/ha), Multi Location Trials (50.5 t/ha) and in On Farm Trials (46.8 t/ha) which is 12.75, 21.3 and 19.7 per cent yield increase over the check CO 1, respectively. The culture TNCS 265 was promoted to All India Coordinated Research Projects on Forage Crops & Utilization trials during the year 2016 to 2018 and it was evaluated at nine locations in the South zone. Among the cultures evaluated, TNCS 265 registered a mean green fodder yield of 69.0 t/ha than the national check CAZRI-76 (54.87 t/ha) and the qualifying variety IGFRI-96-706 (57.98 t/ha) which showed an improvement of 25.76 and 19.01 per cent yield increase over the check, respectively. It ranked first in green fodder yield in all three years of evaluation, under AICRP trials in south zone. It has the crude protein content of 8.18 per cent. The fibre fractions such as Acid Detergent Fibre (%) and Neutral Detergent Fiber (%) were comparatively lesser (42.5 & 64.17 %) than the national check CAZRI-76 (45.43 & 70.4 %) indicating higher digestibility and intake of green fodder of proposed entry. It was also evident from its higher value of *in vitro* Dry Matter Digestibility (55.47 %) than the national check CAZRI-76 (51.93 %). Hence, considering the stable performance of TNCS 265 (*Cenchrus setigerus*), it was proposed and released as *black kolukkattai grass* CO 2 for pasture land cultivation in the south zone of India during 2019 and notified as per Gazette Notification No. S.O. 99(E). dt. 06.01.2020 for general cultivation.

**Key words:** *Cenchrus, kolukkattai* grass fodder, green fodder, dry matter, crude protein

## INTRODUCTION

*Cenchrus* (*Cenchrus* spp.) is a perennial tufted grass which belongs to the family Poaceae and it grows upto 15-120 cm height with erect or decumbent habit and is commonly grown as pasture. A total of 22 species were recognized so far in *Cenchrus*, however only three species *viz., Cenchrus ciliaris* (white *kolukkattai*), *C. setigerus* (black *kolukkattai*) and *C. glaucus* (blue *kolukkattai*) are being used as the forage grass.

In India, it is mainly grown in the traditional pasture land farming system (Adlin *et al*., 2018). *Cenchrus* grass for many centuries has been the predominant plant species in "*Korangadu*", the traditional pastureland farming system existing in the semi arid tract of Tamil Nadu state in South India (Vivekanandan, 2007). It often occurs as wild on sandy soils, but it is also well adapted to deep, freely draining sandy loam, loam, clay loam and red earth soils. Being most drought tolerant of the commonly grown grass, *Cenchrus* grass occurs naturally in areas with an average annual rainfall from as low as 100 mm, but most commonly between 300 and 750 mm.

*Cenchrus* grass when fed green, is said to increase the flow of milk in cattle and impart a sleek and glossy

appearance to the cattle (Kalamani *et al.,* 2011). Fodder quality attributes *viz.,* palatability and digestibility are comparatively high in *Cenchrus* grass thus making it more suitable for raising in pasture lands. *Cenchrus* grass has high soil binding capacity due to its clustered root system in the upper 8-10 cm layer of soil, and hence it can be used for preventing soil erosion (Cook *et al.,* 2005).

*Cenchrus* is suitable for all kinds of grazing animals. It has more nutritive value than sorghum and millet forages and its forage value is highest during the pre-flowering stage (65% *In Vitro* Dry Matter Digestibility). It is considered an excellent pasture grass as it provides highly nutritious and palatable forage during drought periods and can withstand heavy grazing. Apart from its natural range, *Cenchrus* grass can rapidly invade the natural vegetation, roadside and urban landscape, which alters the wildlife regime and displacing the native flora and fauna. It grows from spring to summer and irrigated areas to rainfed areas.

CO 1 (*Cenchrus glaucus*) released from the Department of Forage Crops, Tamil Nadu Agricultural University during 1989 is the only variety available for cultivation in Tamil Nadu. Despite its impressive nature *viz.*, quick growing habit, drought tolerance, high ratoonability, high adaptability and palatability, it remains as a neglected crop from the mainstream of crop improvement research compared to other forage crops and very little genetic information is available. Hence, with the objective to develop a high yielding green fodder variety of *Cenchrus setigerus* suitable for pasture land, an attempt was initiated and to develop a new variety of Black *kolukattai* grass.

## MATERIALS AND METHODS

A selection programme in *Cenchrus setigerus* germplasm was initiated at the Department of Forage Crops, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore during the year 2008. A total of 210 *Cenchrus* germplasm was evaluated for green fodder yield. TNCS 265 is a selection from *Kangeyam* local and selection was made based on green fodder yield. TNCS 265 was subjected to evaluation against *Cenchrus glaucus* CO 1 from 2009 to 2012 under station trial. Further, it was promoted for evaluation under Multi Location Trial from 2012 to 2014 in 24 locations across Tamil Nadu. On Farm Trial was conducted in 100 locations to evaluate the performance of TNCS 265 for green fodder yield from 2016 to 2018. The culture TNCS 265 was evaluated in AICRP trials along with the national check CAZRI-76 and the qualifying entry IGFRI-96-706 during 2016-2018 at different locations of south zone in India. Field screening was conducted to test for leaf blight disease.

## RESULTS AND DISCUSSION

The overall performance of TNCS 265 (*Cenchrus setigerus*) with respect to green fodder yield in Station Trials, Multi Location Trials and On Farm Trials are presented in **Table 1**. Under station trial, TNCS 265 recorded the highest green fodder yield of 38.9 t/ha over the check CO 1 (34.5 t/ha) which is a 12.75 per cent increase over the check CO 1. The culture TNCS 265 was promoted to Multi Location trial and it excelled for green fodder yield in 24 locations throughout Tamil Nadu over the check CO 1. In MLT, it registered the green fodder yield of 50.5 t/ha, while the check CO 1 had recorded 41.6 t/ha. The per cent increase over the check CO 1 was 21.3. On Farm trials were conducted at 100 locations during the year 2016 to 2018. The culture TNCS 265 recorded the highest green fodder yield of 46.8 t/ha which was a 19.7 per cent improvement for green fodder yield over the check CO 1.

The mean green fodder yield of TNCS 265 was 69.0 t/ha under AICRP trials on Forage Crops conducted at nine locations in the south zone of India. TNCS 265 was found to be superior for green fodder yield against the national check CAZRI-76 (54.87 t/ha) and qualifying entry IGFRI-96-706 (57.98 t/ha) with 25.76 and 19.01 per cent improvement, respectively. The culture TNCS 265 ranked first for green fodder yield in all the three years of evaluation in the south zone of India (**Table 2**).

It was superior for dry matter yield (155.71 q/ha) in comparison with the national check CAZRI-76 and qualifying entry IGFRI-96-706 with 31.47 and 28.82 per cent improvement , respectively. The crude protein yield of TNCS 265 was 3.24 q/ha. It was superior to the national check CAZRI-76 by 26.81 per cent and qualifying entry IGFRI-96-706 by 13.98 per cent. It registered a crude protein content of 8.18 per cent which was higher than the national check CAZRI-76 (7.03%) and qualifying entry IGFRI-96-706 (7.78%). The fibre portions such as Acid Detergent Fibre (%) and Neutral Detergent Fibre (%)

**Table 1. Overall mean performance of TNCS 265 for green fodder yield (t/ha) in station trial, MLT and OFT**

| S. No. | Trials | Number of / Locations | TNCS 265 | CO 1 | % increase over CO 1 |
|---|---|---|---|---|---|
| 1 | Research Station Trials (2009-12) | 3 | 38.9 | 34.5 | 12.75 |
| 2 | Multi Location Trials (2012-14) | 24 | 50.5 | 41.6 | 21.30 |
| 3 | On Farm Trials (2016-18) | 100 | 46.8 | 39.1 | 19.70 |
| | Overall Mean | | 45.4 | 38.4 | 18.23 |

**Table 2. Mean performance of TNCS 265 for green fodder yield (t/ha) over three years for south zone under coordinated trials**

| Particulars | Year | Number of locations | Proposed variety TNCS 265 | National check CAZRI-76 (NC) | Qualifying variety IGFRI-96-706 |
|---|---|---|---|---|---|
| VT *Cenchrus setigerus* perennial trial | 2016 | 03 | 82.56 | 73.12 | 66.41 |
| | 2017 | 03 | 68.51 | 50.94 | 58.53 |
| | 2018 | 03 | 55.94 | 40.55 | 49.01 |
| National average | | | 69.00 | 54.87 | 57.98 |
| % superiority over check and qualifying entry | 2016 | 03 | | 12.91 | 24.33 |
| | 2017 | 03 | | 34.50 | 17.05 |
| | 2018 | 03 | | 37.96 | 14.15 |
| % superiority over National average | | | | 25.76 | 19.01 |
| All India rank | 2016 | | 1 | 2 | 3 |
| | 2017 | | 1 | 3 | 2 |
| | 2018 | | 1 | 3 | 2 |

**Table 3. Mean quality values of TNCS 265 in AICRP (FC & U) over three years (2016 to 2018)**

| S. No. | Particulars | Number of / locations | TNCS 265 | National check CAZRI-76 (NC) | Qualifying variety IGFRI-96-706 | % increase over CAZRI-76 (NC) | % increase over IGFRI-96-706 |
|---|---|---|---|---|---|---|---|
| 1 | Dry matter (q/ha) | 3 | 155.71 | 118.44 | 120.88 | 31.47 | 28.82 |
| 2 | Dry matter yield (q/ha/day) | 3 | 0.61 | 0.56 | 0.53 | 8.93 | 14.38 |
| 3 | Crude protein yield (q/ha) | 3 | 3.24 | 2.56 | 2.84 | 26.81 | 13.98 |
| 4 | Crude protein (%) | 4 | 8.18 | 7.03 | 7.78 | 16.33 | 5.19 |
| 5 | Acid Detergent Fibre (%) | 5 | 42.50 | 45.43 | 42.53 | | |
| 6 | Neutral Detergent Fibre (%) | 5 | 64.17 | 70.4 | 68.0 | | |
| 7 | IVDMD (%) | 3 | 55.47 | 51.93 | 54.60 | | |

**Table 4. Disease resistance of TNCS 265 under co-ordinated trials of AICRP (FC & U)**

| Name of the Trial | Year | Disease | TNCS 265 | | CAZRI-76 (NC) | | IGFRI-96-706 | |
|---|---|---|---|---|---|---|---|---|
| | | | Scoring | Reaction | Scoring | Reaction | Scoring | Reaction |
| VTCS 2015 | 2016 | Leaf blight | 1.00 | R | 2.00 | R | 2.00 | R |

contents were comparatively lesser (42.5 % & 64.17 %) than the national check CAZRI-76 (45.43 % & 70.4 %) indicating higher digestibility and intake of green fodder of TNCS 265 which was also discernible from its higher value of IVDMD (55.47 %) than the check (51.93 %) in AICRP on Forage Crops (**Table 3**). Lower NDF per cent is desirable and it might be due to low hemicellulose and less lignifications of the tissues (Jindal and Satpal, 2020). TNCS 265 exhibited resistance to leaf blight in AICRP trials on Forage Crops (**Table 4**).

The proposed culture TNCS 265 is a herbaceous perennial pasture grass having light green and broad leaves, drooping from the middle of leaves and dark purple coloured seeds. The botanical description of TNCS 265 is shown in **Table 5**.

The culture TNCS 265 (*Cenchrus setigerus*) is highly suitable for pasture land under rainfed conditions. Considering the overall performance of *Cenchrus setigerus* - TNCS 265 across the locations, it was proposed and

identified for release as CO 2 (*Cenchrus setigerus*) for pasture land during the Varietal Identification Committee meet, NGM-*Kharif* 2019 held at IGKV, Raipur on 26th February, 2019 for south zone comprising the states of Telangana, Andhra Pradesh, Karnataka and Tamil Nadu. The field view of the variety CO 2 and other distinguishing features of the released variety in comparison with CO 1 are given in **Fig. 1,2 & 3**. The variety CO 2 was released for pasture land cultivation in the south zone of India during 2019 and notified as per Gazette Notification No. S.O. 99(E). dt. 06.01.2020 for general cultivation and seed production. The package of practices for the new variety CO 2 (*Cenchrus setigerus*) is furnished in **Table 6.**

**Table 5. General botanical description of TNCS 265 (*Cenchrus setigerus*)**

| S. No. | Characters | TNCS 265 |
|---|---|---|
| 1. | Leaf colour | Light green |
| 2. | Leaf shape | Broader; drooping from middle of leaves |
| 3. | 4th leaf length (cm) | 25 – 30 |
| 4. | 4th leaf width (cm) | 0.7 – 0.8 |
| 5. | Number of leaf axils /stem | 8 – 10 |
| 6. | Leaf stem ratio | 0.54 |
| 7. | Plant height (cm) | 80 – 85 |
| 8. | Number of tillers per clump | 18 – 20 |
| 9. | Stem girth (cm) | 1.0 – 1.2 |
| 10. | Days to 50% flowering | 75 - 80 days |
| 11. | Flower colour | At 50% flowering- Light Green<br>At maturity; Dark purple |
| 12. | Length of inflorescence (cm) | 10 – 12 |
| 13. | Number of seeds per inflorescence | 90-100 |
| 14. | Seed colour | Dark purple |
| 15. | Seed size | Medium bold |
| 16. | 1000 seed weight (g) | 3.20 – 3.50 |

**Table 6. Package of practices for Black *kolukattai* grass CO 2 (*Cenchrus setigerus*)**

| | | |
|---|---|---|
| Season | : | Throughout the year under irrigated conditions and monsoon season for rainfed |
| Soil | : | Well drained black cotton soil is good. Can also be raised in alkaline soils. |
| Preparatory cultivation | : | Plough 2 to 3 times to obtain a good tilth and form beds and channels of convenient size |
| Manures and fertilizers | : | Basal<br>FYM - 25 tonnes/ha<br>NPK - 75: 50: 25 kg/ha |
| Seed rate | : | 8 kg/ha |
| Spacing | : | 50 × 30 cm |
| Weed management | : | Hand weeding whenever necessary |
| Plant protection | : | Generally, not required for fodder production |
| Water management | : | Immediately after sowing and life irrigation on 3rd day. Then once in 10 days depending on soil type and weather condition |
| Harvest | : | The first harvest 75 - 80 days after sowing<br>Subsequent harvests are made at an interval of 40 - 45 days |
| Green fodder yield | : | 35.6 t/ha/yr (in 7 harvests) |
| Seed treatment | : | Fresh seeds have dormancy of 4 - 6 months. The dormancy of the seeds can be broken by acid scarification of seeds with commercial grade sulphuric acid @ 300 ml per kg of seed for 12 minutes followed by soaking the seeds in the solution of gibberellic acid (500 ppm) or thiourea (0.25%). |

**Fig. 1. Field view of Black *kolukattai* grass CO 2**

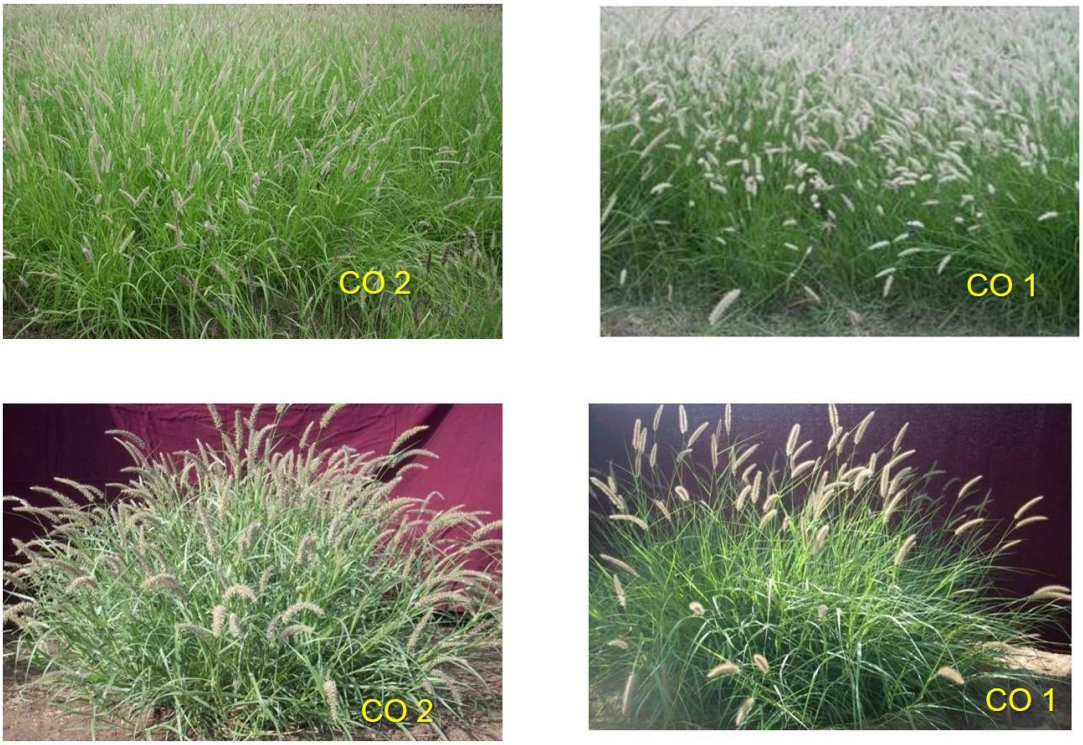


**Fig. 2. Black *kolukattai* grass CO 2 in comparison with the check CO 1**

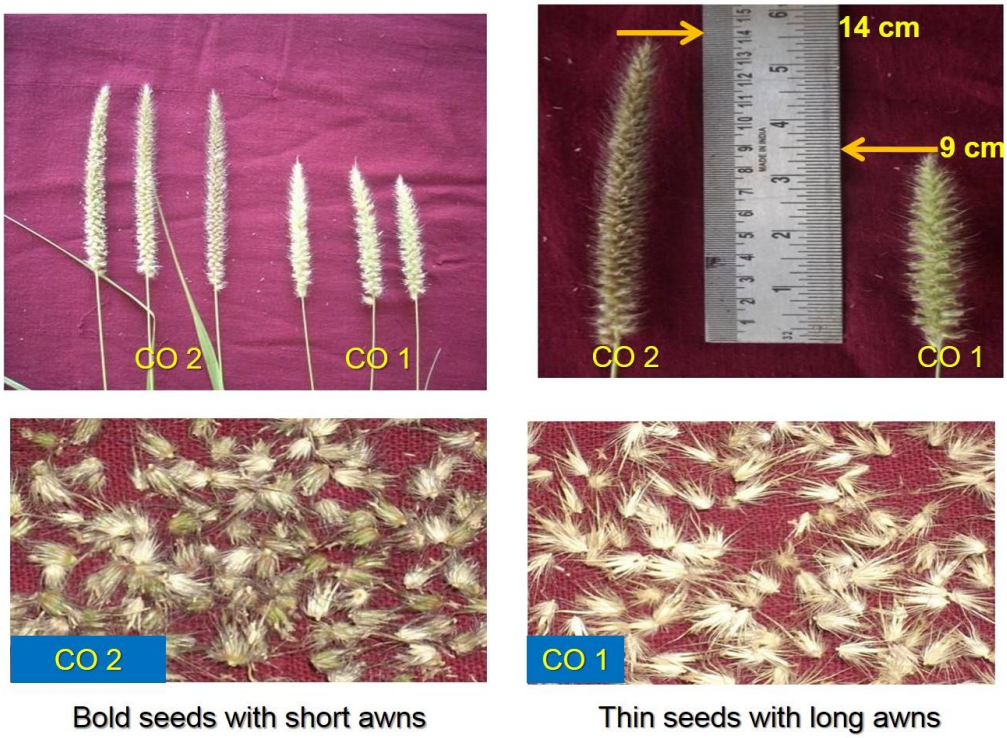


**Fig. 3. Morphological characterization of Black *kolukattai* grass CO 2**

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