

Performance of senna (*Cassia angustifolia* Vahl.) genotypes for growth and yield in the northern dry zone of Karnataka

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Abstract

Nineteen senna (*Cassia angustifolia* Vahl.) genotypes were collected from ICAR-DMAPR, Boriavi, Anand, Gujarat, India and were evaluated for growth and yield characters at Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka during Rabi season of 2024-25. Among all the genotypes evaluated, DCA-127 was the earliest with maximum plant height (55.22 cm), number of primary branches per plant (19.29), number of pods per plant (68) and dry pod yield (30.13 q/ha). Beside this, DCA-127 had maximum leaf area (27.68 cm²) and leaf area index among the genotypes studied. Therefore, this genotype can be used as such after multi-location testing or can further be included in breeding initiatives to produce better varieties.

Keywords: *Cassia angustifolia*, evaluation, leaf area index

Medicinal and aromatic plants play a vital role in traditional and modern healthcare systems worldwide. Among these, senna (*Cassia angustifolia* Vahl.), a member of the family Fabaceae, is a well-known medicinal shrub extensively cultivated for its leaves and pods, which are valued for their laxative properties due to the presence of sennosides (Sharma *et al.*, 2010). Commonly known as Indian senna or Tinnevely senna, it is a drought-tolerant, short-lived perennial species well adapted to arid

and semi-arid regions of India (Rathore and Singh, 2015). The crop has gained significant economic importance as it is one of the major export-oriented medicinal plants, contributing substantially to the herbal drug market (Rani *et al.*, 2018). India is one of the leading producers of senna, with major cultivation concentrated in the arid tracts of Tamil Nadu and Rajasthan, followed by limited areas in Gujarat and Karnataka (Nataraja *et al.*, 2017). The plant thrives in well-drained sandy loam soils under

low rainfall conditions, making it a suitable crop for the dry zones of Karnataka. However, productivity and quality of senna are highly influenced by genotype, soil fertility, and environmental conditions (Patel *et al.*, 2016). Therefore, identifying genotypes that perform well under specific agro-climatic conditions is crucial for maximizing yield and active constituent content.

Considerable genetic variability exists among senna genotypes in terms of growth, yield, and sennoside content (Kumar *et al.*, 2019). Exploiting this genetic variation can aid in selecting high-yielding and quality-rich genotypes suited to regional conditions. Evaluating genotypes across diverse environments also provides insights into genotype $\times$ environment interactions, which are essential for breeding and selection programs (Kandpal *et al.*, 2020). The northern dry zone of Karnataka (Zone 3) is characterized by low and erratic rainfall, high temperature, and poor soil fertility—conditions that often limit the productivity of many crops. However, the hardy nature of senna offers an opportunity for sustainable cultivation in these marginal environments. Despite its potential, limited research has been conducted to evaluate the performance of different senna genotypes under this zone. Hence, the present investigation was undertaken to evaluate the senna

(*Cassia angustifolia* Vahl.) genotypes for growth and yield attributes under the northern dry zone of Karnataka. The study aims to identify promising genotypes with superior growth and yield performance, which could be recommended for commercial cultivation in this region.

The present experiment on the evaluation of senna (*Cassia angustifolia* Vahl.) genotypes was conducted during the rabi season of 2024-25 at the Department of Plantation, Spices, Medicinal and Aromatic Crops, Kittur Rani Channamma

College of Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot, Karnataka, India. The experimental site is located at 16°12' N latitude, 75°45' E longitude and an altitude of 542 m above mean sea level. The region experiences a semi-arid climate with an average annual rainfall of about 550 mm. The soil of the experimental field was medium-deep black soil with a pH of 6.8 moderate fertility and good drainage.

The experimental material consisted of 19 senna genotypes (Table 1) collected from ICAR–Directorate of Medicinal and Aromatic Plants Research (DMAPR), Anand, Gujarat (Anon, 2022). The experiment was laid out in a Randomized Complete Block Design (RCBD) with two replications. Each genotype was planted at a spacing of 30 cm $\times$ 45 cm. All recommended agronomic and plant protection practices were followed uniformly throughout the crop growth period (Patel *et al.*, 2016).

Five healthy and representative plants from the net plot of each genotype in every replication were randomly selected and tagged for recording observations. Plant height (cm), plant spread (North–South and East–West), leaf area (cm²) and leaf area index (LAI) were recorded at 30, 60 and 90 days after sowing (DAS). Fresh leaf yield, dry leaf yield, fresh pod yield, dry pod yield and total yield per plot were recorded at harvest and expressed on plant, plot and hectare basis wherever applicable.

The experimental data were subjected to analysis of variance (ANOVA) appropriate for a Randomized Complete Block Design (RCBD). The statistical analysis of mean values for each character was conducted using standard statistical techniques and tools. The data was interpreted in accordance with Panse and Sukhatme (1985). The significance level for the 'F' test was $p=0.05$. Critical difference (CD) values were determined whenever the 'F' test indicated significance.

Table 1 List of genotypes used in the present study

Sl. No.	Name of the genotype	Source of collection
1	DCA – 113	Genotypes collected from ICAR- DMAPR, Anand, Gujarat
2	DCA – 216	
3	DCA – 165	
4	DCA – 212	
5	DCA – 52	
6	DCA – 140	
7	DCA – 77	
8	DCA – 245	
9	DCA – 114	
10	DCA – 158	
11	DCA – 04	
12	DCA – 176	
13	DCA – 127	
14	DCA – 64	
15	DCA – 104	
16	TL	Local type
17	KKM – 01	Released varieties
18	SONA	
19	ALFT – 02	

Analysis of variance revealed significant differences among the genotypes for all the growth parameters studied (Table 2). The maximum plant height at 90 DAS was recorded in DCA-127 (55.22 cm), which was statistically on par with DCA-04 (54.05 cm), DCA-64 (52.82 cm) and DCA-176 (52.26 cm), whereas the minimum plant height was observed in DCA-212 (42.14 cm). The superior plant height of DCA-127 may be attributed to its greater vegetative vigour, efficient resource utilization and enhanced photosynthetic activity, resulting in better cell elongation and internodal growth.

Plant spread at 90 DAS varied significantly among the genotypes. The maximum plant spread in the north-south direction was recorded in DCA-127 (57.21 cm), whereas ALFT-02 recorded the maximum spread in the east-west direction (60.20 cm). The minimum

plant spread was observed in DCA-113 (44.10 cm) and DCA-212 (46.06 cm) in the north-south and east-west directions, respectively. The wider canopy development in these superior genotypes may be attributed to better vegetative growth, efficient nutrient uptake and higher photosynthetic efficiency, resulting in greater horizontal expansion.

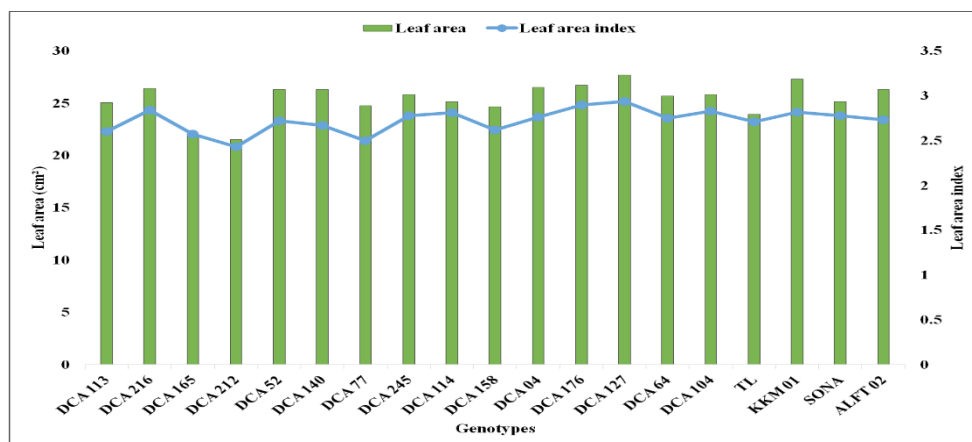
The number of primary branches per plant also differed significantly among the genotypes. The highest number of primary branches was recorded in ALFT-02 (19.97), whereas the lowest was observed in DCA-158 (7.82). However, DCA-127 (19.29), DCA-176 (18.81), KKM-01 (18.21) and DCA-04 (16.66) were statistically on par. The variation in branching behaviour among genotypes may be attributed to genetic differences in axillary bud development, hormonal regulation and assimilate partitioning towards lateral shoot growth. Genotypes with greater vegetative vigour generally produced more branches, thereby increasing their yield potential.

The maximum number of pods per plant was recorded in DCA-127 (68), which was statistically on par with KKM-01 (67), DCA-04 (66), ALFT-02 (65), DCA-64 (64) and DCA-176 (63), whereas the minimum number of pods per plant was recorded in DCA-212 (53). The higher pod production in these genotypes may be associated with increased branching and better assimilate production, which provided more reproductive sites and ultimately improved pod set. Similar findings were reported by Kumar *et al.* (2016), Rani *et al.* (2018) and Kumar *et al.* (2018) in senna.

The mean performance of different genotypes for physiological traits is presented in Figure 1. Among all the genotypes, DCA-127 recorded the highest leaf area at 90 DAS (27.68 cm²), which was statistically on par with KKM-01 (27.28 cm²) and DCA-176 (26.70 cm²), whereas the lowest leaf area was recorded in DCA-212 (21.52 cm²). Similarly, DCA-127 recorded the highest leaf area index (LAI) at 90 DAS (2.94),

Table 2. Performance of senna genotypes for growth characters

Genotype	Plant height (cm)	Plant spread (cm)		No. of primary branches per plant	No. of pods per plant
		N - S	E - W		
DCA- 113	45.77	44.10	49.75	9.95	58
DCA- 216	49.67	51.71	53.86	10.20	62
DCA- 165	43.56	47.77	47.52	8.91	56
DCA- 212	42.14	45.54	46.06	7.94	53
DCA- 52	49.24	51.25	53.46	11.05	62
DCA- 140	49.75	51.74	53.73	11.94	60
DCA- 77	47.04	48.55	50.96	12.74	62
DCA- 245	50.75	52.74	55.02	13.93	61
DCA- 114	47.43	49.98	52.02	11.22	59
DCA- 158	46.53	49.30	51.28	7.82	60
DCA- 04	54.05	54.27	57.53	16.66	66
DCA- 176	52.26	54.29	57.18	18.81	63
DCA- 127	55.22	57.21	58.41	19.29	68
DCA- 64	52.82	53.61	55.86	15.68	64
DCA - 104	51.44	53.43	55.72	14.93	62
TL	45.90	47.94	50.49	10.20	57
KKM- 01	51.84	55.44	56.84	18.21	67
Sona	49.59	51.55	53.61	12.74	60
ALFT - 02	51.94	53.90	60.20	19.97	65
Mean	49.31	51.29	53.65	13.27	61.48
S. Em±	2.29	2.11	1.87	1.27	1.82
C.D. @ 5%	6.68	6.27	4.75	3.78	5.43
CV (%)	11.56	9.28	10.22	11.58	11.21

**Fig. 1.** Leaf area and leaf area index in senna genotypes

which was statistically on par with DCA-176 (2.90) and DCA-216 (2.84), while the lowest LAI was observed in DCA-212 (2.43).

The superiority of DCA-127 for leaf area and LAI may be attributed to its favourable canopy architecture, larger leaf size and higher number of branches, which enhanced light interception and photosynthetic efficiency. Increased leaf area and LAI promote greater biomass accumulation by improving the capacity for photosynthesis. Similar observations were reported by Dwivedi *et al.* (1999) in periwinkle and Singh *et al.* (2003) in senna.

Significant differences were also observed among the genotypes for leaf and pod yields. The maximum fresh and dry leaf yields were recorded in DCA-127 (60.08 and 33.93 q/ha, respectively), whereas the minimum fresh and dry leaf yields were observed in DCA-212 (34.81 and 20.26 q/ha, respectively). Likewise, DCA-127 recorded the highest fresh and dry pod yields (54.54 and 30.13 q/ha, respectively), while the minimum fresh pod yield was recorded in DCA-212 (33.24 q/ha).

Table 3. Yield parameter of the different senna genotypes

Genotype	Leaf yield (q/ha)		Pod yield (q/ha)	
	Fresh leaf	Dry leaf	Fresh pod	Dry pod
DCA- 113	41.68	22.93	39.85	20.19
DCA- 216	47.02	27.01	44.42	23.24
DCA- 165	38.92	21.67	36.54	17.80
DCA- 212	34.81	20.26	33.24	15.82
DCA- 52	45.88	27.24	44.09	24.53
DCA- 140	46.69	26.35	43.63	21.37
DCA- 77	40.18	23.75	37.34	22.03
DCA- 245	49.08	27.27	46.49	24.58
DCA- 114	44.24	25.32	42.37	26.65
DCA- 158	42.35	23.96	39.27	23.32
DCA- 04	56.85	29.41	48.72	27.09
DCA- 176	54.04	29.03	45.29	25.13
DCA- 127	60.08	33.93	54.54	30.13
DCA- 64	52.15	28.10	45.90	26.51
DCA - 104	50.01	27.53	44.37	26.74
TL	43.52	23.72	40.64	21.09
KKM- 01	55.46	29.39	49.22	27.77
Sona	45.84	25.87	43.00	23.78
ALFT - 02	53.57	28.48	51.30	27.73
Mean	47.49	26.38	43.71	23.97
S. Em±	1.18	0.66	1.09	0.59
C.D. @ 5%	3.53	1.96	3.25	1.77
CV (%)	14.53	14.54	14.45	14.51



Fig. 2. Best performed senna genotypes with respect to growth and yield attributes

The superior yield performance of DCA-127 may be attributed to its better vegetative growth, larger leaf area, higher leaf area index, increased branching and greater number of pods per plant. These characteristics enhanced photosynthate production and efficient partitioning of assimilates towards economic yield, resulting in higher fresh and dry leaf and pod yields. Similar findings were reported by Singh *et al.* (2008) in turmeric and Jnanesha *et al.* (2021) in senna. The relationship between enhanced vegetative growth, physiological efficiency and higher biomass production, that improved canopy development and assimilate partitioning contribute significantly to increased crop productivity.

In conclusion, the evaluation of senna (*Cassia angustifolia* Vahl.) genotypes under the northern dry zone of Karnataka demonstrated substantial genetic variability across growth and yield parameters. This variability indicates the presence of rich genetic resources that can be effectively utilized for selection and improvement. Among the genotypes tested, DCA-127, ALFT-02 and KKM-01 consistently exhibited superior performance, combining vigorous vegetative growth, early reproductive transition and higher pod yield, making them strong candidates for both commercial cultivation and further breeding efforts.

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