



COMPARATIVE ANALYSIS OF GROWTH AND FLOWERING CHARACTERISTICS OF *CANNA* CULTIVARS IN AGRO-CLIMATIC CONDITION OF LUCKNOW, UTTAR PRADESH, INDIA

Shilpi Singh, Satish Kumar*, Rameshwar Prasad, R. K. Roy, S. Kumar and A. K. Goel

Botanic Garden Division, C.S.I.R.-National Botanical Research Institute, Lucknow - 226 001 (Uttar Pradesh), India.

Abstract

The present investigation was carried out at the Botanic Garden, CSIR-National Botanical Research Institute, Lucknow (U.P.), India to study the growth and flowering characteristics of *Canna* cultivars belonging to different genera during 2012-13. Ten cultivars viz., Allegheny, Angel Pink, Apricot Dream, Golden Lucifer, King City Gold, Latifolia, Lucifer, Orange Punch, Pink Sunrise and Tropical Sunrise were planted in open field condition during February in each year. Vegetative growth parameters and flower characteristics were analyzed and evaluated. There were significant variations for all the characters among the cultivars studied. Maximum plant height, stem diameter, number of leaves per plant, leaf area, fresh weight of rhizome, rhizome diameter, number of flowers per spike, maximum flower length and width was recorded with Tropical Sunrise followed by Allegheny, Orange Punch and Golden Lucifer. The study indicates that performance of cultivars viz., Tropical Sunrise, Pink Sunrise, Orange Punch, Golden Lucifer and Allegheny was better in respect of growth, rhizome and floral characteristics and recommended for bedding purpose in landscaping.

Key words : *Canna*, characteristics, cultivar, flowering, growth.

Introduction

Canna L. belongs to the family Cannaceae and is important ornamental plant for landscaping in the tropical and sub-tropical regions of the world. Flowers of *Canna* are found in various shades of red, orange, yellow, bi-coloured and multi-coloured forms and are simply stunning. Some of these varieties have variegated foliage with attractive patterns and are equally gorgeous (Bihari *et al.*, 2009).

The generic name has been derived from Greek word 'Kanna', a reed referring to its herbaceous stem. The genus is considered to be indigenous to central-south America and West Indies, but widely naturalized in the tropical and sub-tropical parts of the world. The salient botanical characters of the genus are as follows - stems erect, herbaceous, non-branched. Leaves large, simple, entire with sheathing petioles. Flowers irregular, on terminal raceme or panicle, sepals-3, small usually green; petals-3, narrow and pointed, green coloured, style simple and long; stamens-1, petal-like bearing a half anther on

one side, stamenoides 1-4, petal-like; ovary inferior; fruit a 3-valved capsules with rough outer coat (Roy, 2007). The genus *Canna* is represented by 50-60 species and a large numbers of hybrids. About 10 species have been reported under cultivation in India in Firminger Manual of Gardening in 1864. Out of which *C. glauca*, *C. indica*, *C. iridiflora* and *C. warscewiczii* are important species (Roy, 2009). Cannas are ideal plants for bedding purpose in parks, home gardens, institutional gardens, road dividers and factory gardens besides other various usages in the potted form. Therefore, it has got immense commercial significance in horticultural trade in India. Many R & D Institutions in India have been maintaining the germplasm collections and doing research and improvement work. There is huge demand of new and novel cultivars especially dwarf and floriferous varieties besides having leaf variegations (Roy, 2013).

A large number of varieties of Cannas is commercially grown and no basic data are available on growth parameters and flowering. Therefore, it was

***Author for correspondence:** Dr. Satish Kumar c/o Dr. R.K. Roy, Sr. Principal Scientist, Botanic Garden Division, National Botanical Research Institute, Rana Pratap Marg, Lucknow - 226 001 (U.P.), India.

Table 1 : Comparative analysis of vegetative growth parameters of Canna cultivars.

Cultivars	Plant height (cm)	Stem		Leaf		
		Diameter (cm)	Colour*	Nos. / plant	Leaf area (cm ²)	Colour*
Allegheny	97.60	3.73	Fan 3 Yellow Green Group 144 B	7.33	370.36	Fan 3 Green Group 137 B
Angel Pink	81.83	3.90	Fan 3 Yellow Green Group 144 D	6.33	377.55	Fan 3 Green Group 137 C
Apricot Dream	69.67	4.70	Fan 3 Yellow Green Group 144 A	5.67	504.80	Fan 3 Green Group 137 A
Golden Lucifer	81.07	4.17	Fan 3 Yellow Green Group 145 C	7.17	438.96	Fan 3 Green Group 137 B
King City Gold	64.90	4.10	Fan 3 Yellow Green Group 144 B	5.33	284.47	Fan 3 Green Group 137 B
Latifolia	72.13	3.43	Fan 3 Yellow Green Group 144 A	5.67	502.02	Fan 3 Green Group 137 A
Lucifer	77.37	3.83	Fan 3 Yellow Green Group 149 C	6.67	401.24	Fan 3 Green Group 138 A
Orange Punch	88.53	3.67	Fan 3 Yellow Green Group 145 C	7.57	360.68	Fan 3 Green Group 137 C
Pink Sunrise	73.37	4.77	Fan 3 Yellow Green Group 145 B	6.20	401.02	Fan 3 Green Group 137 A
Tropical Sunrise	98.80	4.93	Fan 3 Yellow Green Group 149 C	7.67	621.56	Fan 3 Green Group 137 C
S. Em. (±)	5.11	0.34		0.31	2.45	
CD (P=0.05)	14.70	0.99		0.90	7.07	

difficult to compare the existing cultivars and select the desirable ones. Considering above, this experiment was conducted to find out suitable cultivars for bedding purpose for garden use by analyzing growth parameters and flowering characters.

Materials and Methods

The present experiment was carried out in the Botanic Garden Division, CSIR-National Botanical Research Institute, Lucknow during 2012-13. Uniform size of rhizomes (3.0-4.0 cm diameter) of ten cultivars *viz.*, Allegheny, Angel Pink, Apricot Dream, Golden Lucifer, King City Gold, Latifolia, Lucifer, Orange Punch, Pink Sunrise and Tropical Sunrise were planted during February in each year. The experiments were laid out in randomized block design with three replications at spacing of 45 × 15 cm. Well decomposed farm yard manure is mixed with the soil @ 3.0 kg/sq. m in addition to single super phosphate and muriate of potash @ 1.0 kg and 0.25 kg per sq. m, respectively before planting (Roy and Banerji, 2006). Light irrigation was given immediately after planting. The experimental site was kept free of weed by periodical hand weeding. Regular irrigations were given as and when required, during crop growth period. Nuvan (Dichlorvos 76% EC) @ 0.2% spray to control the leaf eating caterpillar at 15 days intervals. Uniform package of practices were followed throughout the experiment to grow a healthy crop.

Vegetative growth parameters (plant height, stem

diameter, leaf area, number of leaf per plant), rhizome characteristic (fresh weight, diameter), floral characteristic (flower length, width, flower numbers per spike, spike length) and colour (The Royal Horticultural Society's, Colour Chart, London) were recorded full bloom stage and statistically analyzed to draw conclusion.

Results and Discussion

Growth characteristic

There were significant differences among the varieties under trial (table 1). The mean plant height varied from 64.90 to 98.80 cm. Maximum plant height was recorded in Tropical Sunrise (98.80 cm) followed by Allegheny (97.60 cm), Orange Punch (88.53 cm), Angel Pink (81.83 cm) and Golden Lucifer (81.07cm). Minimum plant height was recorded under King City Gold (64.90 cm). Such a wide range of variability for plant height among the cultivars is mainly due to genetic nature, growing situation and environmental conditions (Roy *et al.*, 2008). The diameter of stem is ranged from 3.43 to 4.93 cm. Maximum stem diameter 4.93 cm was recorded under Tropical Sunrise followed by Pink Sunrise (4.77 cm), Apricot Dream (4.70 cm), Golden Lucifer (4.17 cm) and King City Gold (4.10). Minimum stem diameter was recorded under Latifolia (3.43 cm). The maximum number of leaves per plant (7.67) and leaf area (621.56 cm²) were recorded under Tropical Sunrise. Minimum number of leaves per plant (5.33) and leaf area (284.47 cm²) were recorded under King City Gold.

Table 2 : Comparative analysis of rhizome and floral characteristic *Canna* cultivars.

Cultivars	Rhizome			Spike length (cm)	Flower			
	Fresh weight (g)	Diameter (cm)	Colour*		Length (cm)	Width (cm)	Nos. / spike	Colour**
Allegheny	80.20	3.73	Fan 1 Yellow Orange Group19 B	26.67	10.83	8.50	9.33	Fan 1 Yellow Orange Group20 A
Angel Pink	68.33	3.70	Fan 1 Yellow Group12 D	29.90	9.57	9.70	6.67	Fan 1 Orange Group25 A
Apricot Dream	51.67	3.30	Fan 1 Yellow Group11 C	28.27	9.70	5.40	7.33	Fan 1 Yellow Orange Group23 D
Golden Lucifer	76.67	4.60	Fan 1 Yellow Group11 A	27.00	9.83	4.67	12.67	Fan 1 Yellow Group7 A
King City Gold	66.67	4.27	Fan 1 Yellow Group11 B	21.10	9.17	9.10	5.33	Fan 1 Yellow Group10 C
Latifolia	58.33	3.90	Fan 1 Yellow Group11 C	25.10	10.17	10.97	7.00	Fan 1 Red Group37 A
Lucifer	86.67	4.30	Fan 1 Yellow Group11 C	28.33	9.67	5.63	11.92	Fan 1 Yellow Group8 A
Orange Punch	95.10	3.87	Fan 1 Yellow Group11 D	25.67	9.43	7.20	9.70	Fan 1 Orange Red Group33 A
Pink Sunrise	93.33	3.80	Fan 1 Yellow Group11 D	30.33	10.07	8.20	13.10	Fan 1 Yellow Orange Group14 B
Tropical Sunrise	103.33	5.03	Fan 1 Yellow Group11 C	32.23	11.50	11.33	14.20	Fan 1 Orange Group29 C
S.Em. (±)	991	0.27		3.31	0.61	0.80	3.10	
CD (P=0.05)	28.48	0.78		9.52	1.74	2.30	8.92	

*The Royal Horticultural Society's, Colour Chart, London.

Rhizome and floral characteristic

There were significant differences noticed for fresh weight of rhizome, rhizome diameter, spike length, flower length and width, flowers nos. per spike under trial (table 2). The fresh weight of rhizome was maximum under Tropical Sunrise (103.33 g) followed by Orange Punch (95.10 g), Pink Sunrise (93.33 g), Lucifer (86.67 g) and Allegheny (80.20 g). Minimum fresh weight of rhizome was recorded under Apricot Dream (51.67 g). Maximum rhizome diameter was recorded under Tropical Sunrise (5.03 cm) followed by Golden Lucifer (4.60 cm), King City Gold (4.27 cm), Latifolia (3.90 cm) and Orange Punch (3.87 cm). Minimum rhizome diameter was recorded under Apricot Dream (3.30 cm). Maximum length of spike was recorded under Tropical Sunrise (32.23cm) and minimum under King City Gold (21.10 cm). Number of flowers per spike was higher under Tropical Sunrise (14.20) and lower was recorded under King City Gold (5.33). The highest flower length and width (11.50 and 11.33 cm) were recorded under Tropical Sunrise; minimum flower length and width (9.17 and 4.67 cm) were found Golden Lucifer. Rhizomes diameter and fresh weight may be attributed to the good vegetative growth of plants in initial stages, which provides good amount of photosynthates for storage in rhizomes (Sharga *et al.*, 2008 and Venugopal *et al.*, 2009).

On the basis of the investigation, it may be concluded that the ten cultivars have a great diversity of their morphological characteristic under open field conditions. Following five cultivars *viz.*, Tropical Sunrise, Pink Sunrise, Orange Punch, Golden Lucifer and Allegheny were found better in respect of growth, rhizome and floral characteristic. These cultivars are highly suitable for bedding and landscape purpose.

Acknowledgement

The authors are grateful to the Director, CSIR-NBRI for providing necessary facilities for coordinating field trial. The work was undertaken under the projects funded by CSIR (Networking Project: BSC-0110) and PPV&FRA, Ministry of Agriculture, Government of India.

References

- Bihari, M., S. Narayan, L. Singh, P. Pandey, R. Kumar and A. Singh (2009). Variability studies in canna genotypes. *Journal of Ornamental Horticulture*, **12(3)**: 217-221.
- Roy, R. K. (2007). Plant new Canna varieties in your garden. *Indian Horticulture*, **52 (5)**: 17.
- Roy, R. K. (2009). Agnisikha a Canna ('Keli') (*Canna generalis*) germplasm, a unique new flower colour, flowers in cluster form. *Indian Journal of Plant Genetic Resources*, **22** : 3.
- Roy, R. K. (2013). Fundamentals of Garden Designing : A Colour Encyclopedia. New India Publishing Agency, New Delhi (India), pp.900.
- Roy, R. K. and B. K. Banerji (2006). Canna. *Advances in Ornamental Horticulture* (Ed. S.K. Bhattacharjee), Pointer Pub., Rajasthan. **3** : 256-269.
- Roy, R. K., B. K. Banerji and T. S. Verma (2008). Effect of gamma irradiation on *Canna generalis* 'Confetti' with particular reference to induction of somatic mutation in foliage / flower colour. Proceedings of the DAE-BRNS National Symposium on Landscaping for Sustainable Environment (Nov.20-21, 2008), at BARC, Mumbai, pp. 181-184.
- Sharga, A. N., J. N. Sachan and R. K. Roy (2008). Grow new Canna flowering varieties. *Indian Horticulture*, **53 (4)** : 35.
- Venugopal, C. K., Y. Sharma, K. H. Yashwantkumar and V. S. Patil (2009). Seed germination studies in *Canna indica*. *Journal of Ornamental Horticulture*, **12(1)** : 44-47.