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Revolutionizing ornamental foliage: The impact of nutrients on *Dracaena reflexa* 'song of India' growth, yield and quality in cut foliage production

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Abstract

Dracaena reflexa is a commercially important ornamental foliage plant known for its vibrant, variegated leaves and air-purifying properties. However, achieving optimal growth in tropical climates requires efficient nutrient management. Nano urea and mono potassium phosphate (MKP) boost nutrient uptake, photosynthesis, and stress tolerance, overcoming the inefficiencies of traditional fertilizers. Therefore, the present study was conducted during 2024 - 2025 at the Department of Horticulture, Annamalai University, Tamil Nadu, to assess the effects of nano urea and mono potassium phosphate (MKP) on the growth, yield, and quality of *Dracaena reflexa* 'Song of India' under tropical conditions. The experiment was conducted in a (FRBD) Factorial Randomized Block Design with four levels of nano urea (0%, 0.1%, 0.2%, 0.3%) and mono potassium phosphate (MKP) (0%, 0.25%, 0.50%, 0.75%), applied weekly. Results indicated that the combination of 0.3% nano urea and 0.75% MKP significantly enhanced plant height (55.12 cm), stem girth (4.12 cm), foliage yield (11.38 cut stems/m^2), and quality. This study highlights the importance of targeted foliar nutrition for sustainably maximizing *Dracaena reflexa* 'Song of India' productivity.

Keywords: Cut foliage, *Dracaena reflexa* 'Song of India', Foliar nutrition, Mono potassium phosphate (MKP), Nano urea

Introduction

Floriculture has emerged as a rapidly growing and economically significant sector worldwide. The floriculture industry generated INR 707.81 crores in exports in India during 2022-23 (Sowmya and Harisha, 2024). Cut foliage forms a vital component of this sector, complementing the cut flower trade and contributing significantly to national and international markets (Herath et al., 2013). India's cut foliage exports have experienced fluctuations over the years but have maintained an overall upward trend, reaching 149.51 metric tons and earning Rs. 154.77 lakhs in 2022–23 (APEDA, 2023). Cut foliage refers to vegetation used extensively for decorative purposes, on its own or in floral arrangements. Evergreen plants with green, silver, or variegated leaves are preferred, while species bearing berries are also gaining popularity (Meghana et al., 2023). Common examples include *Asparagus* spp., *Aspidistra elatior*, *Codiaeum variegatum*, *Cyperus* spp., *Dracaena* spp., *Hedera helix*, *Ruscus hypophyllum*, and various wild grasses. Additionally, woody plants' foliage and branches, such as *Callistemon* spp. (bottle brush), *Cycas revoluta*, *Cycas circinalis*, *Eucalyptus* spp., *Euonymus* spp., *Livistona* spp., *Murraya paniculata*, and various palm species are frequently used in floral designs (Bhattacharjee, 1999). Among these, *Dracaena reflexa* 'Song of India', a member of the Asparagaceae family, is widely cultivated for its striking chartreuse foliage and long vase life, making it a preferred cut foliage crop for export (Athulya and Singh, 2021). Native to Madagascar and surrounding islands, it thrives under partial shade and adapts to diverse soil types (Gilman, 1999). In India, it is cultivated for various purposes, including its use in cut foliage, bouquet-making, flower arrangements, and ornamental gardening and is valued for its air-purifying ability, as recognized by NASA's Clean Air Study (Athulya and Singh, 2021).

Despite its importance, there is limited reliable scientific information on optimal nutrient management practices for *Dracaena reflexa* in tropical environments. Among various aspects of cultivation practices, the balanced fertilizer application is essential for the quality production of cut greens. However, nano-fertilizers have opened new avenues for achieving efficient nutrient uptake with minimal environmental impact. Nano urea enhances nitrogen uptake due to its high surface area and controlled release (Verma et

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al., 2023), while mono potassium phosphate provides readily available phosphorus and potassium, essential for photosynthesis, root growth, and stress tolerance (Rawat et al., 2022). Hence, the present study was undertaken to assess the impact of foliar-applied nano urea and mono potassium phosphate on the growth, yield, and quality of *Dracaena reflexa* 'Song of India' under tropical conditions, aiming to develop a targeted nutrient strategy for sustainable cut foliage production.

Materials and methods

The present experiment was conducted from 2024 - 2025 to evaluate the effects of nano urea (N) and mono potassium phosphate (MKP) on the growth, yield, and quality of *Dracaena reflexa* 'Song of India' at Kallampatti village, Pattukkottai, Thanjavur, Tamil Nadu and the quality analysis was carried out at the Department of Horticulture, Annamalai University, Annamalainagar, Tamil Nadu. The experimental site location is at an altitude of ±28 m above mean sea level (MSL), latitude of 10°19' North and longitude of 79°15' East. The average maximum temperature is 33° C, whereas the average minimum temperature is 26° C. The annual average rainfall is 814.4 mm. The mean relative humidity is 64.5 percent. A Factorial Randomized Block Design (FRBD) was employed with 16 treatments replicated three times. It consisted of two factors: nitrogen (nano urea) and phosphorus-potassium (mono potassium phosphate), with four levels each. The nano urea treatments included N_0 (0.0%), N_1 (0.1%), N_2 (0.2%), and N_3 (0.3%), while the mono potassium phosphate treatments consisted of MKP_0 (0.0%), MKP_1 (0.25%), MKP_2, (0.50%), and MKP_3 (0.75%), all applied at weekly intervals. Since *Dracaena reflexa* is a foliage plant that requires adequate shade for optimal growth and development, a 60% green shade net was used to regulate light conditions (Rashika and Karuppaiah, 2025b). The main field was prepared with a growing media consisting of two parts of garden soil and one part of burnt rice husk, farmyard manure (FYM), and cocopeat (2:1:1:1 v/v) (Rashika and Karuppaiah, 2025a). Raised beds of 30 cm height were prepared and divided into 48 plots measuring 2.0 m x 2.0 m per plot. Six-month-old rooted cuttings with a uniform height were selected and transplanted on ridges at 60 cm × 60 cm spacing (Rashika and Karuppaiah, 2025b) to ensure proper plant growth and uniformity. Initial irrigation was provided immediately following transplantation, followed by two subsequent irrigations at two-day intervals. Additional irrigations were administered as required. The plots were maintained free from weeds over the growing period by hand weeding at regular intervals. The first weeding was carried out 20 days after planting and thereafter when required.

Biometric observations were made on various growth and physiological parameters, including plant height, stem girth, number of leaves/plant, leaf length, leaf breadth, number of cut stems/plant, number of cut stems/m^2, chlorophyll content (SPAD), visual scoring and vase life of cut foliage without pulsing. These observations were recorded 270 days after planting. The relative leaf chlorophyll content was estimated with a (SPAD 502) chlorophyll meter as the SPAD index. Visual quality of cut foliage was assessed based on leaf colour, texture, shape, tip, margin, and overall appearance using a 10-point hedonic scale. Ratings were categorized as Excellent (9.1–10), Very Good (8.1–9.0), Good (6.1–8.0), Acceptable (5.1–6.0), and Unacceptable (0–5.0) (Gowshika Devi and Karuppaiah, 2021). Data recorded, thus, were subjected to statistical analysis as per the procedure outlined by Panse and Sukhatme (1978) and the results were tested at 5 per cent level of significance.

Results and discussion

Effect of nutrients on growth parameters

The data in Table 1 shows that the Nano urea (N) and Mono potassium phosphate (MKP) combination positively influences the plant growth of *Dracaena reflexa* 'Song of India'. The maximum plant height (55.12 cm) and most significant stem girth (4.12 cm) were observed under the N_3 x MKP_3 (0.3% Nano urea with 0.75% Mono potassium phosphate). Conversely, the minimum values for plant height (33.76 cm) and stem diameter (1.74 cm) were noted under N_0 x MKP_0 (Control). Nano-fertilizers enhance growth due to their ultra-small size and large surface area, which improve leaf penetration and nutrient absorption (Sharma et al., 2022). Nano urea boosts enzymatic activity, photosynthate translocation, and auxin synthesis, promoting cell division and elongation for vigorous vegetative growth (Mahmoud et al., 2020; El-Shawa et al., 2022; Saikumar et al., 2022). Similar results have been reported in lettuce crop (Abdel, 2018) and *Philodendron* spp., (El-Shawa et al., 2022). Mono potassium phosphate (MKP) supports root and shoot development by ensuring optimal physiological functions. These results align with previous studies Sahithi et al. (2023) in marigold and (Gowtham and Karuppaiah, 2024) in *Crossandra.*

The number of leaves per plant (56.13) (Table 1) was maximized under the combination of N_3 x MKP_3 compared to the control (N_0 x MKP_0). The combination of 0.3% nano urea (N_3) and 0.75% mono potassium phosphate (MKP_3) leads to an increase in leaf number due to the complementary effects of nitrogen, phosphorus, and potassium. Nitrogen (N_3) enhances chlorophyll content, provides essential proteins and nucleotides necessary for leaf formation (Sharma et al., 2022) while, Potassium (MKP_3) enhances stomatal conductance,

Table 1. Effect of nutrients on growth parameters of *Dracaena reflexa* 'Song of India' at 270 days after planting.

Treatments	Plant height (cm)	Stem girth (cm)	Number of leaves/plant	Leaf length (cm)	Leaf breadth (cm)	Number of cut stems/plant
$N_0 \times MKP_0$	33.76	1.74	35.09	12.14	1.30	1.69
$N_0 \times MKP_1$	35.36	2.17	37.03	12.29	1.36	1.80
$N_0 \times MKP_2$	36.72	2.30	38.04	12.52	1.51	1.82
$N_0 \times MKP_3$	38.07	2.51	40.17	13.04	1.67	1.93
$N_1 \times MKP_0$	39.30	2.65	41.37	13.53	1.83	2.14
$N_1 \times MKP_1$	43.42	2.89	45.06	14.16	2.03	2.66
$N_1 \times MKP_2$	44.74	3.21	46.43	14.93	2.09	2.76
$N_1 \times MKP_3$	46.28	3.14	46.57	14.65	2.06	2.87
$N_2 \times MKP_0$	40.65	2.76	43.06	13.7	1.90	2.34
$N_2 \times MKP_1$	47.88	3.40	47.02	15.19	2.11	3.10
$N_2 \times MKP_2$	50.95	3.53	51.09	16.81	2.20	3.42
$N_2 \times MKP_3$	52.55	3.61	53.32	17.53	2.22	3.66
$N_3 \times MKP_0$	41.98	3.00	43.64	13.91	2.00	2.53
$N_3 \times MKP_1$	49.44	3.45	49.42	15.27	2.19	3.21
$N_3 \times MKP_2$	53.92	3.74	54.79	17.55	2.25	3.87
$N_3 \times MKP_3$	55.12	4.12	56.13	17.94	2.50	4.11
CD	1.33	0.14	1.31	0.35	0.08	0.11
SE(d)	0.63	0.07	0.63	0.17	0.04	0.05

CO_2 assimilation, and root water uptake, improving photosynthesis, stress tolerance, and delaying leaf senescence, which increases growth and foliage yield. Phosphorus (MKP_3) fuels ATP production, supporting rapid cell division in the shoot meristem. These results are in line with the studies of Mathew et al. (2022) in *Chrysanthemum morifolium* cv. Branfountain Purple and Sahithi et al. (2023) in marigold.

Effect of nutrients on yield parameters

The combined application of 0.3% nano urea and 0.75% mono potassium phosphate (MKP) ($N_3 \times MKP_3$) significantly enhanced leaf morphology and stem production in *Dracaena reflexa*. The leaf length (17.94 cm) and leaf breadth (2.50 cm), along with the number of cut stems per plant (4.11) (shown in Table 1) and per square meter (11.38) (shown in Table 2), were recorded maximum under this treatment ($N_3 \times MKP_3$) compared to the control ($N_0 \times MKP_0$). Nano urea increases leaf area and biomass, while mono-potassium phosphate supports root growth, energy transfer, and stomatal function. Together, they enhance physiological processes, leading to vigorous growth, stronger tissues, and higher cut foliage yield (Salim et al., 2014; Gondwal et al., 2024). The results are in similar with, Nair et al. (2015) in leather leaf fern, Gowshika Devi and Karuppaiah (2021) in *Dracaena reflexa* 'variegata' and Kalyani et al. (2024) in *Gerbera jamesonii*.

Effect of nutrients on quality parameters

Regarding quality parameters such as Chlorophyll content SPAD (45.12), visual scoring (9.01), and vase life of foliage without pulsing (12.74 days) were recorded the maximum at N_3 x MKP_3 and the minimum under control (Table 2). The combined application of 0.3% Nano Urea and 0.75% MKP enhances the visual quality of *Dracaena reflexa* by improving nutrient metabolism, boosting chlorophyll synthesis, leaf pigmentation, and plant vigour (Salim *et al*., 2014). Nano Urea promotes darker, broader leaves, while MKP supports cell integrity and leaf turgidity, preventing premature aging (Sharma et al., 2022). These findings are in accordance with Chandana and Dorajeero (2014) in *Gladiolus grandiflorus*, Ma et al. (2021) in rose, and Gowtham and Karuppaiah in crossandra (2024).

Table 2. Effect of nutrients on yield and quality parameters of *Dracaena reflexa* 'Song of India' at 270 days after planting.

Treatments	Number of cut stems/m^2	Chlorophyll (SPAD)	Visual Scoring	Vase life without pulsing (days)
$N_0 \times MKP_0$	4.68	25.67	5.01	7.99
$N_0 \times MKP_1$	4.98	28.74	5.18	8.97
$N_0 \times MKP_2$	5.04	30.07	6.13	9.38
$N_0 \times MKP_3$	5.34	32.09	6.23	9.55
$N_1 \times MKP_0$	5.92	32.15	6.47	9.67
$N_1 \times MKP_1$	7.36	36.18	6.89	10.49
$N_1 \times MKP_2$	7.64	37.76	7.34	10.53
$N_1 \times MKP_3$	7.94	39.52	7.46	10.78
$N_2 \times MKP_0$	6.48	33.09	6.54	9.86
$N_2 \times MKP_1$	8.58	40.54	7.58	11.17
$N_2 \times MKP_2$	9.47	42.53	8.54	11.49
$N_2 \times MKP_3$	10.13	43.26	8.61	11.56
$N_3 \times MKP_0$	7.00	33.46	6.73	10.14
$N_3 \times MKP_1$	8.89	42.17	8.14	11.38
$N_3 \times MKP_2$	10.71	43.65	8.76	12.04
$N_3 \times MKP_3$	11.38	45.12	9.01	12.74
CD	0.34	1.40	0.20	0.40
SE(d)	0.17	0.68	0.09	0.20

Conclusion

The combined application of 0.3% Nano urea and 0.75% Mono potassium phosphate significantly enhanced the growth, yield and quality of *Dracaena reflexa* 'Song of India'

under tropical conditions. This study highlights the effectiveness of nano-fertilizers and balanced nutrient management for sustainable and profitable cut foliage production. Future research may focus on exploring the nutrient-induced physiological and biochemical changes in enhancing foliage durability under different storage conditions.

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