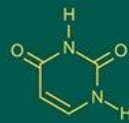


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Shubhashree DK
PG Scholar, Horticulture
Section, College of Agriculture,
Dr. Panjabrao Deshmukh
Krishi Vidyapeeth, Akola,
Maharashtra, India

Dr. Neha K Chopde
Associate Professor,
Horticulture Section, College of
Agriculture, Nagpur,
Maharashtra, India

Dr. Seema A Thakre
Assistant Professor,
Horticulture Section, College of
Agriculture, Nagpur,
Maharashtra, India

Dr. Ommala D Kuchanwar
Associate Professor, Soil
Science Section, College of
Agriculture, Nagpur,
Maharashtra, India

Pallavi Thakre
Young Professional, College of
Agriculture, Nagpur,
Maharashtra, India

Priyanka N
PG Scholar, Horticulture
Section, College of Agriculture,
Nagpur, Maharashtra, India

Corresponding Author:
Shubhashree DK
PG Scholar, Horticulture
Section, College of Agriculture,
Dr. Panjabrao Deshmukh
Krishi Vidyapeeth, Akola,
Maharashtra, India

Effect of calcium nitrate and PDKV micro-grade II on growth, yield and quality of gladiolus

Shubhashree DK, Neha K Chopde, Seema A Thakre, Ommala D Kuchanwar, Pallavi Thakre and Priyanka N

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Abstract

A field experiment entitled “Effect of calcium nitrate and PDKV micro-grade II on growth, yield and quality of gladiolus” was conducted during the rabi season of 2025-26 at Satpuda Botanic Garden, College of Agriculture, Nagpur (M.S.). The experiment was conducted to find out the influence of foliar application of calcium nitrate and PDKV micro-grade II on the growth, flowering, yield and quality of gladiolus and to find out the best treatment combination. The experiment was conducted in Factorial Randomized Block Design with sixteen treatment combination of four levels of calcium nitrate (0, 0.5, 1.0 and 1.5%) and four levels of PDKV micro-grade II (0, 0.5, 1.0 and 1.5%). The treatment combination of 1.0% calcium nitrate + 1.5% PDKV micro-grade II (C₃M₄) recorded maximum plant height, spike length and florets per spike indicating its superiority for vegetative growth and spike yield. The application of 1.5% calcium nitrate (C₄) and 1.5% PDKV micro-grade II (M₄) significantly improved leaf area, spikes per plant, vase life, corms per plant and cormels per plant. Earliness in flowering was observed with 1.5% calcium nitrate (C₄) and 1.0% PDKV micro-grade II (M₃). Overall, the combination of 1.0% calcium nitrate + 1.5% PDKV micro-grade II was found most effective for enhancing growth and spike quality, whereas 1.5% calcium nitrate and 1.5% PDKV micro-grade II proved superior for improving corm and cormel yield.

Keywords: Gladiolus, calcium nitrate, PDKV micro-grade II, vegetative growth, spike quality, corm yield

Introduction

Gladiolus (*Gladiolus grandiflorus* L.), popularly known as the “Queen of Bulbous Flower Crops,” is one of the most important commercial cut flowers in India. Its attractive spikes, wide colour range, long vase life, and excellent keeping quality make it highly desirable for bouquets, floral arrangements, and landscaping. With increasing domestic and export demand, gladiolus has emerged as a profitable floriculture crop contributing significantly to India’s cut flower industry. The production of superior-quality spikes depends on balanced nutrient management. While macronutrients drive vegetative growth, calcium and micronutrients are crucial for enhancing spike strength, floret quality, corm development, and post-harvest longevity. Foliar application of calcium nitrate supplies readily available calcium and nitrate, improving cell wall stability, nutrient uptake, and delaying senescence. Similarly, micronutrients such as iron, zinc, boron, manganese, copper, and molybdenum are indispensable for chlorophyll synthesis, enzyme activation, photosynthesis, pollen germination, and protein metabolism. Deficiencies in these elements directly reduce growth, flowering, and yield. Considering the rising demand for premium gladiolus flowers, foliar nutrition offers an efficient approach to improve nutrient use efficiency and flower quality. The combined application of calcium nitrate and PDKV micro-grade II is expected to enhance growth, spike yield, corm production, and overall quality attributes. Therefore, the present investigation entitled “Effect of calcium nitrate and PDKV micro-grade II on growth, yield and quality of gladiolus” was undertaken to evaluate different concentrations and identify the most suitable combination for achieving superior crop performance.

Materials and Methods

The experiment was conducted during the winter season of 2025-26 at the Satpuda Botanic Garden, College of Agriculture, Nagpur, Maharashtra, to evaluate the effect of calcium

nitrate and PDKV Micro-grade II on the growth, flowering, yield and quality of gladiolus (*Gladiolus grandiflorus* L.) cv. PDKV Satpuda Purple. The trial was laid out in a factorial randomized block design (FRBD) comprising sixteen treatment combinations with three replications. Uniform, healthy corms (4-5 cm diameter) were treated with 0.3% Captan before planting on ridges and furrows at a spacing of 45 cm × 15 cm. The recommended fertilizer dose of 300:200:200 kg N:P₂O₅: K₂O ha⁻¹ was applied and foliar sprays of calcium nitrate (0, 0.5, 1.0 and 1.5%) and PDKV Micro-grade II (0, 0.5, 1.0 and 1.5%) were given twice at the four-leaf and six-leaf stages. Standard agronomic practices, including irrigation, weeding, earthing-up, staking and plant protection, were followed throughout the crop growth period. Five randomly selected plants from each plot were used to record observations on growth, flowering, spike quality, vase life, corm and cormel yield. Statistical analysis of the recorded data was carried out following the methodology proposed by Panse and Sukhatme (1967) [11].

Results and Discussion

1. Effect of calcium nitrate

a. Growth parameters

At 60 days after planting, calcium nitrate significantly improved growth traits in gladiolus. Maximum plant height (80.78 cm) was recorded with 1.0% concentration (C₃), followed by 1.5% (C₄, 75.92 cm). Leaf area was highest under 1.5% calcium nitrate (C₄, 106.47 cm²), statistically at par with 1.0% (C₃, 104.62 cm²). The improvement in growth parameters is attributed to nitrogen being a major constituent of chlorophyll and proteins, which enhance photosynthesis, stem elongation, and leaf development. Similar findings were reported by Padmalatha *et al.* (2014) [10] and Nagamani *et al.* (2017) [8] in gladiolus.

b. Flowering parameters

The earliest spike initiation (54.08 days) was observed with 1.5% calcium nitrate (C₄), at par with 1.0% calcium nitrate (C₃, 55.00 days). Maximum spikes per plant (2.62) and longest spike length (104.69 cm) were recorded with 1.5% (C₄), both statistically at par with 1.0% (C₃, 2.60 spikes; 103.15 cm length). The highest florets per spike (16.30) and longest vase life (9.62 days) were noted under 1.5% calcium nitrate (C₄), at par with 1.0% (C₃, 16.07 florets; 9.43 days). Optimum calcium levels strengthened cell structures, boosted cell division, and delayed senescence, thereby enhancing floret count and vase life. These results align with Padmalatha *et al.* (2014) [10], Nagamani *et al.* (2017) [8] in gladiolus and Abood (2017) [2] in *Tulipa* sp.

c. Corm yield and quality parameters

The highest number of corms per plant (2.73) was recorded under 1.5% concentrations (C₄), at par with 1.0% (C₃, 2.68). Similarly, maximum cormels per plant were obtained with 1.5% calcium nitrate (C₄, 21.17), statistically at par with 1.0% (C₃, 21.03). The improvement in yield attributes is attributed to calcium and nitrogen promoting cell division, cell wall rigidity, biomass distribution, chlorophyll synthesis, and photosynthetic product accumulation. These processes strengthen source-sink relationships, enhance starch synthesis, and support daughter cormel formation. Comparable results in gladiolus were reported by Qureshi *et al.* (2015) [12], Reddy and Sarkar (2016) [13], and Ahmad and Rab (2020) [3].

2. Effect of PDKV micro-grade II

a. Growth parameters

Maximum plant height (82.03 cm) was recorded under 1.5% concentration (M₄), followed by 1.0% concentration (M₃, 77.00 cm). Leaf area was also highest in 1.5% concentration (M₄, 106.73 cm²), statistically at par with M₃ i.e. 1.0% (104.10 cm²). The improvement in growth parameters may be attributed to zinc promoting tryptophan synthesis for auxin production and nitrogen metabolism, along with boron, calcium, and magnesium enhancing cell division, enlargement, and chlorophyll synthesis. Similar findings were reported by Abid Kamal *et al.* (2022) [1] and Harish *et al.* (2023) [5] in gladiolus.

b. Flowering parameter

The earliest spike initiation (53.50 days) was observed under 1.0% concentration (M₃), at par with 1.5% (M₄, 55.50 days). Maximum spikes per plant (2.70) and longest spike length (106.47 cm) were recorded under 1.5% concentration (M₄) followed by M₃ i.e. 1.0% concentration (2.57 spikes; 103.41 cm length). The highest florets per spike (16.43) and longest vase life (9.81 days) were obtained under M₄ i.e. 1.5% concentration, at par with 1.0% (M₃, 16.28 florets; 9.49 days). Improved micronutrient status enhanced physiological processes and delayed senescence, thereby extending vase life. These findings align with Sharma *et al.* (2013) [14], Katiyar *et al.* (2005) [7], Fahad *et al.* (2014) [4], Naik *et al.* (2015) [9], Kashyap and Tikey (2022) [6], and Harish *et al.* (2023) [5] in gladiolus.

c. Corm yield and quality parameters

The highest number of corms per plant (2.78) was recorded under 1.5% concentration (M₄), followed by 1.0% (M₃, 2.65). Similarly, maximum cormels per plant were obtained with M₄ i.e. 1.5% concentration (21.33), statistically at par with M₃ i.e. 1.0% concentration (20.70). The observed increase in yield attributes may be attributed to adequate micronutrient supply through foliar application. Zinc plays a key role in enzyme activity, auxin and cytokinin synthesis, and balancing phosphorus and potassium uptake. In association with other micronutrients, zinc improves chlorophyll function, carbohydrate partitioning, and dry matter translocation towards corm and cormel development. These findings were in line with Singh *et al.* (2012) [15], Fahad *et al.* (2014) [4], and Kashyap and Tikey (2022) [6].

3. Interaction effect

The interaction between calcium nitrate and PDKV micro-grade II levels was significant for growth and quality traits in gladiolus (Table 2). The combination of 1.0% calcium nitrate with 1.5% PDKV micro-grade II (C₃M₄) recorded the maximum plant height (93.58 cm) at 60 DAP, longest spike length (112.19 cm), and highest number of florets per spike (17.80). This synergistic effect highlights the complementary roles of macronutrients and micronutrients in enhancing vegetative growth, optimizing structural development, and maximizing spike production. Calcium strengthens cell walls and delays senescence, while micronutrients such as zinc and boron stimulate enzyme activity, hormone synthesis, and floral differentiation. Their combined application improves nutrient uptake, photosynthesis, and assimilate partitioning, thereby enhancing overall growth

and yield attributes. Similar synergistic benefits of combined nutrient application in gladiolus have been

reported by Katiyar *et al.* (2005) [7], supporting the present findings.

Table 1: Effect of calcium nitrate and PDKV micro-grade II on plant growth, spike quality and corm yield in gladiolus

Treatment	Height of gladiolus plant (cm) 60 DAP	Leaf area (cm ²)	Days to first spike emergence (days)	Spikes plant ⁻¹	Length of spike (cm)	Florets spike ⁻¹	Vase life (days)	Corms plant ⁻¹	Cormels plant ⁻¹
A) Calcium nitrate (C)									
C ₁ -Water spray	70.60	98.84	57.67	2.42	97.73	15.33	8.80	2.53	18.95
C ₂ -0.5%	72.64	101.61	56.42	2.47	100.00	15.38	9.04	2.62	20.27
C ₃ -1.0%	80.78	104.62	55.00	2.60	103.15	16.07	9.43	2.68	21.03
C ₄ -1.5%	75.92	106.47	54.08	2.62	104.69	16.30	9.62	2.73	21.17
F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m)±	1.35	1.52	0.88	0.05	0.95	0.20	0.12	0.05	0.35
CD at 5%	3.89	4.38	2.55	0.14	2.75	0.58	0.35	0.14	1.02
B) PDKV micro-grade II (M)									
M ₁ -Water Spray	69.73	99.45	57.83	2.38	97.00	14.92	8.62	2.53	19.55
M ₂ -0.5%	71.18	101.25	56.33	2.45	98.70	15.45	8.96	2.60	19.83
M ₃ -1.0%	77.00	104.10	53.50	2.57	103.41	16.28	9.49	2.65	20.70
M ₄ -1.5%	82.03	106.73	55.50	2.70	106.47	16.43	9.81	2.78	21.33
F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m)±	1.35	1.52	0.88	0.05	0.95	0.20	0.12	0.05	0.35
CD at 5%	3.89	4.38	2.55	0.14	2.75	0.58	0.35	0.14	1.02
C) Interaction effect (C x M)									
F' test	Sig.	NS	NS	NS	Sig.	Sig.	NS	NS	NS
SE (m)±	2.70	3.04	1.77	0.09	1.91	0.40	0.24	0.10	0.71
CD at 5%	7.78	-	-	-	5.50	1.16	-	-	-

Table 2: Interaction effect of calcium nitrate and PDKV micro-grade II on plant growth and quality of spike in gladiolus

Treatments	Plant height (cm) 60 DAP	Length of spike (cm)	Florets spike ⁻¹
C ₁ M ₁	67.98	96.09	14.00
C ₁ M ₂	70.31	97.30	15.27
C ₁ M ₃	71.47	98.27	15.53
C ₁ M ₄	72.64	99.25	15.53
C ₂ M ₁	69.15	96.32	14.73
C ₂ M ₂	70.31	98.63	15.13
C ₂ M ₃	74.96	101.20	16.20
C ₂ M ₄	76.13	103.84	15.47
C ₃ M ₁	71.47	97.30	14.93
C ₃ M ₂	72.64	98.94	15.00
C ₃ M ₃	85.43	104.17	16.53
C ₃ M ₄	93.58	112.19	17.80
C ₄ M ₁	70.31	98.27	15.00
C ₄ M ₂	71.47	99.93	16.40
C ₄ M ₃	76.13	109.98	16.87
C ₄ M ₄	85.77	110.60	16.93
F' test	Sig.	Sig.	Sig.
SE (m)±	2.70	1.91	0.40
CD at 5%	7.78	5.50	1.16

Conclusion

From the present experimental trial, it is concluded that the maximum vegetative growth, flower yield, quality parameters and corm attributes were recorded under 1.5% concentration of calcium nitrate and 1.5% concentration of PDKV micro-grade II. The treatment combination of 1.0% calcium nitrate + 1.5% PDKV micro-grade II (C₃M₄) was found to be superior in respect plant height, spike length and number of florets spike⁻¹.

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