

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(7): 1591-1596
www.biochemjournal.com
Received: 18-04-2026
Accepted: 20-05-2026

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Effect of pruning dates and micronutrient strengths on leaf physiological parameters in jasmine

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DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i7Ss.9274>

Abstract

A field study was carried out from 2024 to 2026 at the Department of Floriculture and Landscaping, Dr. Y.S.R. Horticultural University in Andhra Pradesh, aimed at assessing the impact of different pruning dates and foliar applications of FeSO₄, ZnSO₄ and MgSO₄ on the physiological, biochemical and yield characteristics of *Jasminum sambac* cv. CO.1 Gundumalli. The experimental design utilized was a Factorial Randomized Block Design that included four distinct pruning dates alongside four micronutrient treatments. The interaction between the timing of pruning and the levels of micronutrients had a significant effect on all examined traits. Specifically, the treatment P₁M₃ (pruning on December 25 combined with foliar applications of FeSO₄, ZnSO₄ and MgSO₄ at a concentration of 0.5% each) achieved the highest values for relative water content (88.17%), leaf area (28.03 cm²), chlorophyll content (61.79 SPAD units), total phenols (3.62 mg g⁻¹), soluble protein content (13.84 mg g⁻¹) and flower cymes per plant (957.00). These findings suggest that conducting pruning on December 25 followed by monthly applications of FeSO₄, ZnSO₄ and MgSO₄ at a rate of 0.5% is an effective strategy to enhance physiological efficiency and optimize flower yield in *J. sambac* cv. CO.1 Gundumalli.

Keywords: *J. sambac*, foliar micronutrients, physiological traits, pruning date, flower yield

Introduction

Jasmine (*Jasminum sambac* Ait.) represents a significant commercial loose flower crop in India, esteemed for its beautiful and fragrant blossoms which are utilized in religious rituals, garlands, hair accessories, as well as in the perfume, cosmetic and essential oil sectors. The success of flower production is heavily reliant on effective crop management practices, with pruning being particularly crucial. This process entails the removal of older shoots to encourage vigorous new growth, enhance light availability and air circulation, decrease disease prevalence, and improve flowering outcomes (Gibson, 1984; Anderson, 1991) [3, 2]. Prior research has indicated that performing pruning during December or January leads to notable improvements in both growth and flower yield for *J. sambac*. However, the ideal timing for pruning can differ based on cultivar and agro-climatic factors (Singh and Moe, 1980; Pal and Bose, 1981; Pawar *et al.*, 2019; Khanchana and Jawaharlal, 2019) [16, 10, 12, 6]. In addition to pruning, balanced nutrition is critical for enhancing plant growth, flowering capabilities, and flower quality. Among secondary and micronutrients, elements such as iron, zinc and magnesium are essential for processes including chlorophyll production, photosynthesis enhancement, enzyme activation, auxin generation, protein metabolism, carbohydrate conversion, and pollen development (Wallihan *et al.*, 1958; Thorne, 1957; Shukla *et al.*, 2009; Mengel and Kirkby, 2001; Marschner, 2012) [20, 19, 14, 9, 8]. A lack of these nutrients can negatively impact plant development and flower output. While there has been considerable research into the individual impacts of pruning and nutrient management separately, knowledge regarding their combined effects remains scarce. Consequently, this study was conducted to assess how varying pruning dates alongside foliar applications of iron, zinc, and magnesium influence the physiological characteristics and yield of *J. sambac* cv. CO.1 Gundumalli.

Materials and Methods

The research was carried out from August 2024 to July 2026 in the Floriculture and Landscaping department at the College of Horticulture, Dr. Y.S.R. Horticultural University, located in Venkataramannagudem. A Factorial Randomized Block Design (FRBD) with two replications was employed

for the experiment. The first factor involved four different pruning dates (P₁, P₂, P₃, and P₄), while the second factor included four levels of micronutrient applications (M₁, M₂, M₃, and M₄).

Description of treatments

(P ₁ M ₁)	:	25 th December + (FeSO ₄ @ 0.3% + ZnSO ₄ @ 0.3% + MgSO ₄ @ 0.3%)
(P ₁ M ₂)	:	25 th December + (FeSO ₄ @ 0.4% + ZnSO ₄ @ 0.4% + MgSO ₄ @ 0.4%)
(P ₁ M ₃)	:	25 th December + (FeSO ₄ @ 0.5% + ZnSO ₄ @ 0.5% + MgSO ₄ @ 0.5%)
(P ₁ M ₄)	:	25 th December + Water spray
(P ₂ M ₁)	:	15 th January + (FeSO ₄ @ 0.3% + ZnSO ₄ @ 0.3% + MgSO ₄ @ 0.3%)
(P ₂ M ₂)	:	15 th January + (FeSO ₄ @ 0.4% + ZnSO ₄ @ 0.4% + MgSO ₄ @ 0.4%)
(P ₂ M ₃)	:	15 th January + (FeSO ₄ @ 0.5% + ZnSO ₄ @ 0.5% + MgSO ₄ @ 0.5%)
(P ₂ M ₄)	:	15 th January + Water spray
(P ₃ M ₁)	:	5 th February + (FeSO ₄ @ 0.3% + ZnSO ₄ @ 0.3% + MgSO ₄ @ 0.3%)
(P ₃ M ₂)	:	5 th February + (FeSO ₄ @ 0.4% + ZnSO ₄ @ 0.4% + MgSO ₄ @ 0.4%)
(P ₃ M ₃)	:	5 th February + (FeSO ₄ @ 0.5% + ZnSO ₄ @ 0.5% + MgSO ₄ @ 0.5%)
(P ₃ M ₄)	:	5 th February + Water spray
(P ₄ M ₁)	:	25 th February + (FeSO ₄ @ 0.3% + ZnSO ₄ @ 0.3% + MgSO ₄ @ 0.3%)
(P ₄ M ₂)	:	25 th February + (FeSO ₄ @ 0.4% + ZnSO ₄ @ 0.4% + MgSO ₄ @ 0.4%)
(P ₄ M ₃)	:	25 th February + (FeSO ₄ @ 0.5% + ZnSO ₄ @ 0.5% + MgSO ₄ @ 0.5%)
(P ₄ M ₄)	:	25 th February + Water spray

A new *J. sambac* cultivar named CO.1 Gundumalli, also referred to as 'Nine Budded Gundumalli,' has been introduced by the Department of Floriculture and Landscape Architecture at Tamil Nadu Agricultural University in Coimbatore (Fig. 1). This distinct variety is noted for its increased yield of nine-budded cymes per plant, demonstrating greater productivity compared to the traditional Ramanathapuram Gundumalli variety. Rooted cuttings aged ten months were transplanted into the main field with a spacing of 1.2 x 1.2 meters. Pruning was conducted according to the established schedule up to a

height of 50 cm above ground level, followed by monthly foliar applications of micronutrients post-pruning. Regular observations were made on the pruned plants over two years (2024-25 and 2025-26), during which data were collected regarding various physiological leaf parameters such as Relative Water Content (RWC) (%), leaf area (cm²), chlorophyll content (measured in SPAD units), total phenol content (mg g⁻¹), soluble protein content (mg g⁻¹) and yield metrics like the number of flower cymes per plant. The data analysis was performed using ANOVA methods as described by Panse and Sukhatme (1985)^[11].



Fig 1: Field view of 9-budded cyme *J. sambac* CO.1 Gundumalli

Results and Discussion

Relative water content (RWC) and leaf area

The pooled data presented in Table 1 revealed that pruning dates, micronutrient strengths and their interaction significantly influenced relative water content (RWC) and leaf area of *J. sambac*. Among the pruning dates, P₃ recorded the highest mean RWC (81.61%), followed by P₂ (79.85%) and P₁ (77.17%), whereas the lowest RWC was observed in P₄ (53.93%). With respect to micronutrient strengths, M₁ registered the highest mean RWC (79.53%), followed by M₂ (77.56%), while the untreated control (M₄)

recorded the lowest value (63.14%). The interaction effect was also significant, with the highest RWC (88.17%) recorded in the P₃M₁ treatment combination, whereas the lowest value (45.91%) was observed in P₄M₄. A similar trend was observed for leaf area. Among the pruning dates, P₃ produced the maximum mean leaf area (24.90 cm²), followed by P₂ (24.28 cm²) and P₁ (23.17 cm²), while P₄ recorded the minimum (20.48 cm²). Among the micronutrient treatments, M₁ resulted in the highest mean leaf area (25.10 cm²), followed by M₂ (23.62 cm²) and M₃ (22.48 cm²), whereas M₄ recorded the lowest value (21.62

cm²). The interaction between pruning dates and micronutrient strengths was significant, with the maximum leaf area (28.03 cm²) recorded under P₃M₁, while the minimum (19.71 cm²) was obtained under P₄M₄.

Chlorophyll content, total phenols and soluble proteins

The pooled data (Table 2) indicated that chlorophyll content and total phenols were significantly affected by pruning dates, micronutrient strengths and their interaction.

Among the pruning dates, P₃ recorded the highest mean chlorophyll content (53.78 SPAD units), followed by P₂ (51.82 SPAD units) and P₁ (48.77 SPAD units), whereas the lowest value (38.31 SPAD units) was observed under P₄. Among the micronutrient strengths, M₁ produced the highest mean chlorophyll content (54.04 SPAD units), followed by M₂ (51.80 SPAD units), while the untreated control (M₄) registered the lowest value (41.64 SPAD units). The interaction effect was significant, and the maximum chlorophyll content (61.79 SPAD units) was recorded in P₃M₁, whereas the minimum (36.93 SPAD units) was observed in P₄M₄. The trend for total phenols was similar. Among the pruning dates, P₃ registered the highest mean phenol content (2.79 mg g⁻¹), followed by P₂ (2.47 mg g⁻¹) and P₁ (2.35 mg g⁻¹), whereas P₄ recorded the lowest value (1.78 mg g⁻¹). Among the micronutrient strengths, M₁ recorded the highest mean total phenols (2.84 mg g⁻¹), followed by M₂ (2.58 mg g⁻¹) and M₃ (2.15 mg g⁻¹), while M₄ recorded the lowest (1.82 mg g⁻¹). The highest total phenol content (3.62 mg g⁻¹) was observed under P₃M₁, whereas the lowest (1.72 mg g⁻¹) was recorded under P₄M₄.

The pooled results presented in Table 3 showed that soluble protein content were significantly influenced by pruning dates, micronutrient strengths and their interaction. Among the pruning dates, P₃ recorded the highest mean soluble protein content (12.27 mg g⁻¹), followed by P₂ (11.79 mg g⁻¹) and P₁ (11.28 mg g⁻¹), whereas the lowest value (9.59 mg g⁻¹) was recorded under P₄. Among the micronutrient strengths, M₁ produced the highest mean soluble protein content (12.25 mg g⁻¹), followed by M₂ (11.82 mg g⁻¹) and M₃ (10.74 mg g⁻¹), while M₄ recorded the minimum (10.12 mg g⁻¹). The interaction effect was significant, with the highest soluble protein content (13.84 mg g⁻¹) recorded under P₃M₁, whereas the lowest (9.14 mg g⁻¹) was recorded under P₄M₄.

Early pruning (P₁) markedly increased chlorophyll content, relative water content, total phenol content and soluble protein accumulation as compared those under later pruning dates. This might be due to rejuvenating effect by pruning, producing younger, physiologically active shoots with higher photosynthetic potential. Pruning also improved light penetration and canopy aeration, supporting chlorophyll synthesis and effective assimilate utilization. Kumaresan *et al.* (2017)^[7] in *J. sambac* observed similar increases in chlorophyll and soluble protein after pruning. Sanjay *et al.* (2010)^[13] in mango reported comparable improvements in physiological and biochemical attributes following the operation of pruning as evident from vigorous shoot and leaf development in their study.

The steady rise in micronutrient concentration from M₁ to M₃ corresponded with increases in all physiological and biochemical parameters. Iron and magnesium are directly involved in chlorophyll formation, whereas zinc activates numerous enzymes linked to photosynthesis, protein synthesis and carbohydrate metabolism. Adequacies in

supply of these elements enhanced chloroplast formation, pigment accumulation and metabolic activity, elevating chlorophyll content under the high dose of M₃. Srividhya *et al.* (2021)^[17] in jasmine recorded higher SPAD chlorophyll readings and improved physiological efficiency after foliar micronutrient application. Shyala *et al.* (2019)^[15] also reported chlorophyll increases from micronutrient nutrition in ornamentals.

Among treatment combinations, P₁M₃ recorded the highest values for all physiological and biochemical traits, whereas P₄M₄ produced the lowest. The superior performance of P₁M₃ suggests that optimal pruning combined with balanced foliar nutrition enhanced physiological efficiency and metabolic functioning.

Relative water content, an indicator of plant water status and cellular hydration, was higher under P₁M₃, reflecting improved water uptake, efficient translocation and maintenance of cellular turgor. Magnesium aids in osmotic regulation, while zinc helps to preserve membrane stability and stomatal function, collectively improving tissue water retention. Elevated RWC sustains physiological processes and delays dehydration. Zahed *et al.* (2006)^[21] in gladiolus and Thamaraiselvi (2009)^[18] in *J. sambac* linked higher tissue water content with better physiological performance and delayed senescence.

Significantly greater phenol content as recorded under P₁M₃ might be due to enhanced secondary metabolism stemming from favourable nutritional and physiological conditions. Phenolic compounds act as antioxidants and protectants against oxidative stress. Micronutrients serve as cofactors for enzymes in the phenylpropanoid pathway, promoting phenol biosynthesis. Sanjay *et al.* (2010)^[13] in mango and Kaushik *et al.* (2020)^[5] in peach reported increased total phenols with improved canopy management and pruning.

Soluble protein content was found to increase with every increase in micronutrient levels, peaking under M₃. This might be due to improved nitrogen assimilation, enzyme production and protein metabolism. Zinc regulates enzymes involved in protein synthesis, iron participates in nitrate reduction and amino acid formation; and magnesium supports ribosomal function and protein assembly. Hence, optimal micronutrient application could encourage greater soluble protein accumulation in leaves. Kumaresan *et al.* (2017)^[7] recorded similar increases in soluble proteins in *J. sambac* under treatments that enhanced physiological efficiency. Srividhya *et al.* (2021)^[17] also reported higher nitrate reductase activity and protein content following foliar micronutrient application in jasmine.

Number of cymes per plant

The pooled results presented in Table 3 showed that number of cymes per plant were significantly influenced by pruning dates, micronutrient strengths and their interaction. The number of cymes per plant varied significantly among the treatments. Among the pruning dates, P₃ recorded the highest mean number of cymes (772.65 plant⁻¹), followed by P₂ (727.12 plant⁻¹) and P₁ (647.97 plant⁻¹), whereas P₄ recorded the lowest (418.38 plant⁻¹). Among the micronutrient strengths, M₁ produced the highest mean number of cymes (772.77 plant⁻¹), followed by M₂ (707.50 plant⁻¹) and M₃ (584.94 plant⁻¹), while M₄ registered the minimum (500.91 plant⁻¹). The interaction between pruning dates and micronutrient strengths was significant, with the highest number of cymes (957.00 plant⁻¹) observed in P₃M₁,

whereas the lowest (364.87 plant⁻¹) was recorded under P₄M₄.

The greater numbers of buds per cyme and cymes per plant under P₁M₃ may be due to improved sink establishment during reproduction. Bud formation depends on the availability of actively growing shoots capable of differentiating floral primordia. Early pruning increased productive shoot numbers, while optimal micronutrient nutrition ensured a steady nutrient supply for ongoing bud

differentiation. Better nutritional status also reduced premature bud abortion, allowing more number of initiated buds to maturity and transformation into marketable buds. Abdou and Badran (2003)^[1] in *J. sambac* observed similar increases in cymes and buds with pruning through improved assimilate availability. Jennoah *et al.* (2012)^[4] reported that increased leaf production after pruning boosted carbohydrate reserves, resulting in higher bud production in jasmine.

Table 1: Influence of pruning dates and micronutrient strengths and their interaction on Relative Water Content (RWC) and Leaf area (pooled means)

Treatment	RWC (%)					Leaf area (cm ²)				
Pruning dates (P)	Micronutrient strengths (M)									
	M ₁	M ₂	M ₃	M ₄	Mean	M ₁	M ₂	M ₃	M ₄	Mean
P ₁	83.66 (66.15)	86.17 (68.16)	88.17 (69.88)	60.10 (50.81)	79.53 (63.75)	24.90	26.27	28.03	21.20	25.10
P ₂	81.93 (64.84)	84.57 (66.86)	85.51 (67.62)	58.24 (49.73)	77.56 (62.26)	23.83	25.05	25.52	20.08	23.62
P ₃	78.28 (62.21)	78.86 (62.62)	80.68 (63.92)	51.47 (45.82)	72.32 (58.64)	22.19	23.11	23.73	20.92	22.48
P ₄	64.79 (53.59)	69.81 (56.66)	72.06 (58.09)	45.91 (42.63)	63.14 (52.74)	21.77	22.70	22.31	19.71	21.62
Mean	77.17 (61.70)	79.85 (63.58)	81.61 (64.88)	53.93 (47.25)	73.14 (59.34)	23.17	24.28	24.90	20.48	23.21
Factors	P		M		PxM	P		M		PxM
SEm±	0.20		0.20		0.41	0.09		0.09		0.19
CD @ 5%	0.62		0.62		1.25	0.28		0.28		0.56

Table 2: Influence of pruning dates and micronutrient strengths and their interaction on Chlorophyll content and total phenols (pooled means)

Treatment	Chlorophyll content (SPAD units)					Total phenols (mg g ⁻¹)				
Pruning dates (P)	Micronutrient strengths (M)									
	M ₁	M ₂	M ₃	M ₄	Mean	M ₁	M ₂	M ₃	M ₄	Mean
P ₁	54.82	59.80	61.79	39.75	54.04	2.84	3.06	3.62	1.85	2.84
P ₂	52.81	56.84	58.84	38.70	51.80	2.77	2.85	2.92	1.78	2.58
P ₃	45.51	47.73	49.73	37.85	45.20	1.96	2.11	2.75	1.76	2.15
P ₄	41.94	42.92	44.78	36.93	41.64	1.82	1.84	1.89	1.72	1.82
Mean	48.77	51.82	53.78	38.31	48.17	2.35	2.47	2.79	1.78	2.35
Factors	P		M		PxM	P		M		PxM
SEm±	0.06		0.06		0.13	0.01		0.01		0.01
CD @ 5%	0.19		0.19		0.38	0.02		0.02		0.03

Table 3: Influence of pruning dates and micronutrient strengths and their interaction on Soluble proteins and Number of cymes per plant (pooled means)

Treatment	Soluble proteins (mg g ⁻¹)					Number of cymes per plant				
Pruning dates (P)	Micronutrient strengths (M)									
	M ₁	M ₂	M ₃	M ₄	Mean	M ₁	M ₂	M ₃	M ₄	Mean
P ₁	12.13	13.09	13.84	9.93	12.25	763.87	913.51	957.00	456.72	772.77
P ₂	11.87	12.75	12.96	9.73	11.82	729.48	797.83	864.65	438.05	707.50
P ₃	10.80	10.90	11.67	9.59	10.74	587.18	646.57	692.13	413.88	584.94
P ₄	10.31	10.41	10.62	9.14	10.12	511.38	550.56	576.83	364.87	500.91
Mean	11.28	11.79	12.27	9.59	11.23	647.97	727.12	772.65	418.38	641.53
Factors	P		M		PxM	P		M		PxM
SEm±	0.01		0.01		0.03	0.27		0.27		0.54
CD @ 5%	0.04		0.04		0.09	0.81		0.81		1.62

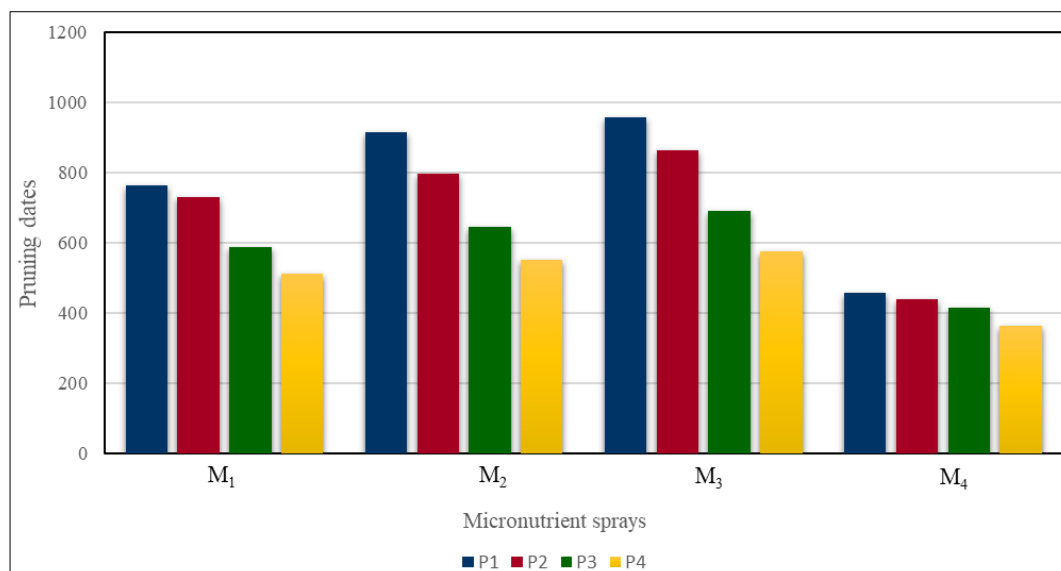


Fig 2: Number of cymes per plant as influenced by pruning dates and micronutrient sprays.

P ₁	:	25 th December
P ₂	:	15 th January
P ₃	:	5 th February
P ₄	:	25 th February
M ₁	:	FeSO ₄ @ 0.3% + ZnSO ₄ @ 0.3% + MgSO ₄ @ 0.3%
M ₂	:	FeSO ₄ @ 0.4% + ZnSO ₄ @ 0.4% + MgSO ₄ @ 0.4%
M ₃	:	FeSO ₄ @ 0.5% + ZnSO ₄ @ 0.5% + MgSO ₄ @ 0.5%
M ₄	:	Water spray

Conclusion

Early pruning, when combined with the appropriate application of foliar micronutrients, significantly improved the physiological, biochemical and yield characteristics of *J. sambac*. The treatment combination P₁M₃ consistently demonstrated higher relative water content, chlorophyll levels, total phenols, soluble proteins and the number of cymes per plant, reflecting enhanced plant vigour and metabolic efficiency. Therefore, implementing early pruning alongside balanced micronutrient nutrition is advisable for optimizing growth, physiological performance, and flower production in jasmine.

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