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Response of Floribunda Rose cv. Mirabel to different fertilization levels on growth and flowering

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Abstract

Rose cultivation is highly nutrient-intensive and conventional fertilization often leads to nutrient losses and suboptimal performance. A field experiment was conducted from September 2024 to July 2025 to evaluate the effect of different fertilization levels on Floribunda rose cv. Mirabel. The study comprised seven treatments with graded NPK levels applied through fertigation and conventional soil application, laid out in a Randomized Block Design with three replications. Pooled analysis revealed that 175% RDF (87.5:87.5:131.25 g N:P:K/plant/year) through fertigation recorded the highest plant height (99.08 cm), number of primary (6.03) and secondary branches (30.10), leaf count (328.53), stem girth (22.58 mm) and plant spread (84.58 cm E-W; 94.85 cm N-S). The same treatment exhibited the earliest bud initiation (24.22 days), 50% flowering (27.84 days) and complete flower opening (32.45 days). Overall, fertigation treatments markedly outperformed conventional soil fertilization in promoting growth, and flowering with plant response showing a positive and progressive improvement up to 175% RDF in Floribunda rose cv. Mirabel.

Keywords: Floribunda, fertigation, nutrient management and Mirabel

Introduction

“Of all the flowers, methinks a rose is best,” said by William Shakespeare. The rose (*Rosa hybrida* L.) is globally recognized as the “Queen of Flowers” for its aesthetic appeal, fragrance and cultural significance. Taxonomically, the rose belongs to the family Rosaceae, with a chromosome number of $2n = 14$, and the genus *Rosa* comprises approximately 200 species and over 18,000 cultivars worldwide. Roses account for nearly 25-30% of the global cut flower trade, highlighting their economic importance (Pruthvi, 2016) [17]. India ranks first in cut rose cultivation, contributing 46.54% of the total area dedicated to the crop rose. The country produces approximately 498.23 million tons annually, with Karnataka being a key contributor, having about 38,000 hectares under flower cultivation in 2021-22. Of this, 5,073 hectares are devoted to rose cultivation, yielding 21,486 metric tons at an average productivity of 4.23 t/ha (Anon., 2022) [1]. The demand for loose flowers in the domestic market has increased greatly, with Floribunda roses contributing a major share. Among the various groups of garden roses, Floribunda roses have gained remarkable popularity and significance. No flower has made such remarkable progress in recent years.

The term “Floribunda,” derived from Latin, means “many-flowering.” These cultivars, developed by crossing Hybrid Tea and Polyantha roses (Hybrid Polyanthas), are vigorous, medium-tall and cold-tolerant, producing abundant clusters of medium to large blooms. Floribunda roses exhibit diverse colour forms and growth habits, making them suitable for both ornamental and commercial purposes. While traditionally used as hedge plants for landscaping, they are now widely cultivated for loose flowers and garlands due to prolific blooms, attractive form and fragrance. In Karnataka, Floribunda roses are primarily grown in Bengaluru Rural, Kolar, Chikkaballapura, Tumakuru, Mysuru and Belagavi districts (Vijayalaxmi *et al.*, 2017) [22]. Floribunda roses represent an important group of modern rose hybrids celebrated for their prolific blooming and ornamental versatility. Among the notable cultivars, the cv. Mirabel stands out as a superior red-flowering type distinguished by its early and continuous blooming

behaviour, dwarf, compact growth habit and remarkable adaptability under diverse agro-climatic conditions. The cultivar produces an abundance of medium-sized, loose flowers even with minimal pruning, making it particularly suitable for intensive commercial cultivation. Its vivid floral hue, extended blooming duration and consistent market preference have positioned the cv. Mirabel as a dominant in domestic loose flower segment. Beyond its commercial significance, Mirabel also serves as an ideal bedding and landscape plant owing to its neat architecture and sustained floral display. Morphologically, it is a multi-stemmed, deciduous shrub exhibiting an upright, spreading habit, typically attaining 90-120 cm in height and 90-105 cm in canopy spread. The cultivar performs optimally under full sunlight and in well-drained, fertile soils, but remains sensitive to water stagnation. Its profuse and year-round flowering potential not only enhances its aesthetic value but also underscores its commercial importance in contemporary floriculture systems (Praveen *et al.*, 2021)^[16].

Roses are nutrient-demanding crops that require precise fertilization. Conventional fertilization practices often lead to nutrient losses, whereas fertigation-the application of water-soluble fertilizers through drip irrigation-ensures efficient nutrient delivery to the root zone, enhancing uptake, flower yield and quality while reducing wastage (Hebbbar *et al.*, 2004; Neilsen and Peryea, 1999)^[6, 10]. Crop productivity and quality are primarily governed by a plant's genetic potential, its interaction with the environment and its nutrient responsiveness. Effective and balanced nutrient management is crucial for optimizing growth, yield and overall crop performance. In conventional fertilization, substantial nutrient losses occur through leaching, volatilization or fixation, which limit plant availability and reduce nutrient use efficiency. The form, timing and method of nutrient application critically influence uptake and assimilation. Among the essential macronutrients, nitrogen (N), phosphorus (P) and potassium (K) are required in substantial quantities, each playing a complementary role in plant growth, development, and reproduction. Fertigation, by supplying these nutrients in soluble form and at precise doses, minimizes nutrient losses, enhances nutrient use efficiency and significantly improves vegetative growth, flowering, yield and ornamental quality particularly in nutrient-intensive crops such as rose. Therefore, the present study was undertaken to formulate fertigation-based nutrient management strategies for achieving sustainable and high-quality rose production.

Materials and Methods

The present experiment was conducted at the Horticultural Research and Extension Centre, Hidkal Dam (University of Horticultural Sciences, Bagalkot), located in Hukkeri taluk, Belagavi district, Karnataka. The research was conducted during the period from September 2024 to July 2025. The experimental site lies in Agro-Climatic Zone VIII of Karnataka, characterized by hot summers and mild winters, with temperatures ranging from 8°C in December to 42°C in April and May. The region receives an average annual rainfall of 600-700 mm, mostly during the South-West monsoon from June to September. The experimental soil was red sandy loam with medium fertility, a pH of 7.15, and an electrical conductivity of 0.17 dS/m. The soil

composition comprised 47.5% sand, 17.5% silt and 35% clay with an infiltration rate of 3 cm per hour.

The experiment was conducted using a Randomized Block Design (RBD) with seven treatments and three replications on one-year-old, well-established plants of Floribunda rose cv. Mirabel. Each plot measured 4.5 m x 9 m, providing a net plot area of 40.5 m². The study commenced after light pruning on 15th September 2024, retaining a minimum number of primary shoots to ensure uniform growth. Bordeaux paste (1%) was applied to the pruned ends to prevent dieback and fungal infections.

Fertilizers were supplied through fertigation in all treatments except T₆ and T₇. The treatments were: T₁: 75% RDF (37.5:37.5:56.25 g NPK/plant/year) through fertigation, T₂: 100% RDF (50:50:75 g NPK/plant/year) through fertigation, T₃: 125% RDF (62.5:62.5:93.75 g NPK/plant/year) through fertigation, T₄: 150% RDF (75:75:112.5 g NPK/plant/year) through fertigation, T₅: 175% RDF (87.5:87.5:131.25 g NPK/plant/year) through fertigation, T₆: 100% RDF (50:50:75 g NPK/plant/year) through conventional soil application in three split doses as a farmer practice and T₇: Absolute control (no fertilizer). For fertigation, Water-soluble fertilizers such as NPK (19:19:19; Nineteen all) and sulphate of potash [SOP (0:0:50)] were used and applied at fortnightly intervals to ensure uniform nutrient availability to the plants.

Observations recorded

Five plants were chosen at random from each plot and labelled to record observations on characters viz., plant height (cm), number of primary and secondary branches, number of leaves per plant, stem girth (mm) and plant spread (N-S and E-W) (cm²). Flowering parameters included days to bud initiation after pruning, days to 50% flowering and days to complete flower opening. Data were statistically analysed as per Panse and Sukhatme (1985)^[12] using standard procedures at a 5% level of significance ($p = 0.05$). Critical difference (CD) values were calculated wherever the 'F' test was found significant.

Results and Discussion

Growth parameters

During the present study, a progressive enhancement in vegetative growth was observed with increasing levels of NPK applied through fertigation. Treatment T₅ (175% RDF through fertigation) exhibited significantly superior performance, recording the maximum plant height (75.23 cm and 99.08 cm), number of primary branches (5.19 and 6.03) and secondary branches (21.09 and 30.10) at 90 and 180 days after pruning (DAP), respectively, depicted in (Figure 1). The increase in height and branching may be attributed to the continuous and balanced supply of nutrients to the root zone through fertigation, which enhanced nutrient uptake, photosynthetic efficiency and cytokinin activity in shoots, stimulating meristematic cell division and lateral bud initiation. These findings are supported by the work of Sindhu and Yamdagni (1992)^[20], Vidhyasankar and Bhattacharjee (2000)^[21], Viradia and Singh (2002)^[23] and Palai *et al.* (2002)^[11] in rose and by Patel (2004)^[14], Chawla *et al.* (2007)^[4], Joshi *et al.* (2013)^[7] and Sahana *et al.* (2019)^[19] in chrysanthemum and Zehra *et al.* (2014)^[24] in gerbera.

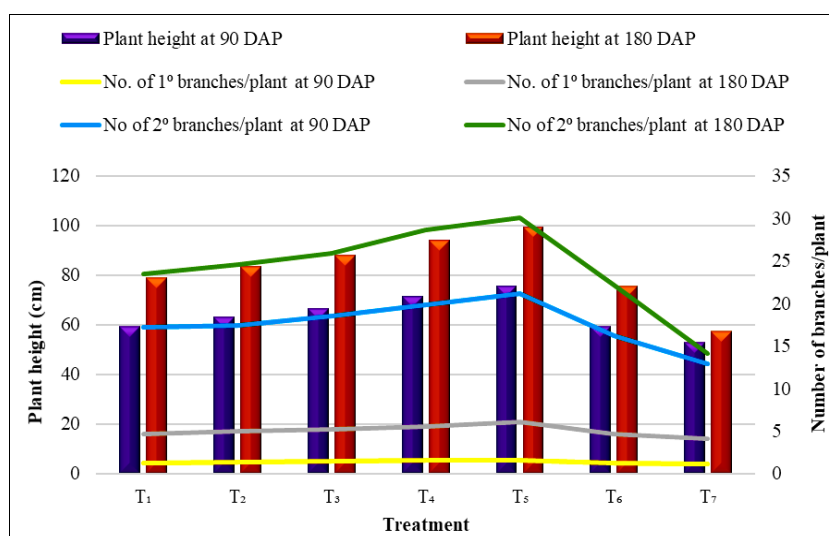


Fig 1: Plant height and number of branches/plant in Floribunda rose cv. Mirabel as influenced by different fertigation level

Fertigation also significantly influenced foliage development and stem thickness, with T₅ recording the highest number of leaves per plant (188.76 and 328.53) and stem girth (19.76 mm and 22.58 mm) at 90 and 180 DAP, respectively as illustrated in (Figure 2). The higher leaf production may be attributed to nitrogen-induced enhancement in chlorophyll synthesis and carbohydrate accumulation, while increased stem girth resulted from greater cambial activity and assimilate translocation. Similar findings were observed by Kejkar and Polara (2014) [8] in spider lily and by Parihar (2014) in gaillardia. Barad *et al.* (2015) [2] and Fayaz *et al.* (2016) [5] reported comparable results in gerbera, while Choudhary *et al.* (2018) recorded similar observations in rose. The maximum plant spread (70.52 cm and 84.58 cm E-W; 69.72 cm and 94.85 cm N-S) as shown in (Figure 3) under T₅ was attributed to enhanced rhizosphere nutrient availability, which stimulates cellular proliferation and expansion in the shoot meristem. Precise nutrient delivery via fertigation optimizes chlorophyll biosynthesis, photosynthetic assimilation and the partitioning of photo assimilates toward peripheral tissues, thereby promoting extensive canopy architecture. Improved nutrient-use efficiency and sustained metabolic activity under fertigation collectively contribute to

superior vegetative expression and lateral growth as reported by Paul *et al.* (1996) [15]. These results are in line with the findings of Palai *et al.* (2002) [11] in rose and Sahana *et al.* (2019) [19] in chrysanthemum.

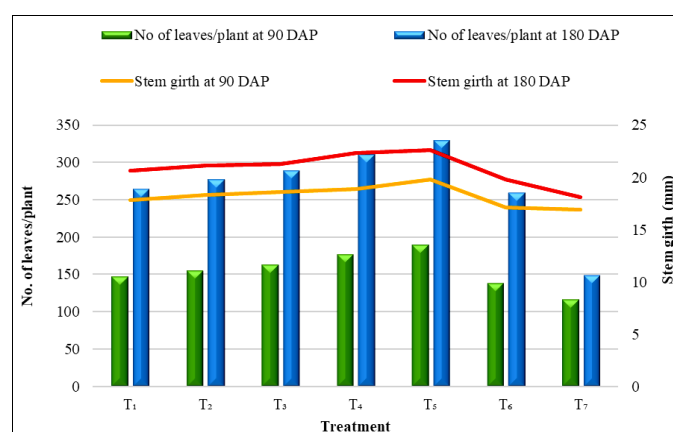


Fig 2: No. of leaves/plant and stem girth in Floribunda rose cv. Mirabel as influenced by different fertigation level

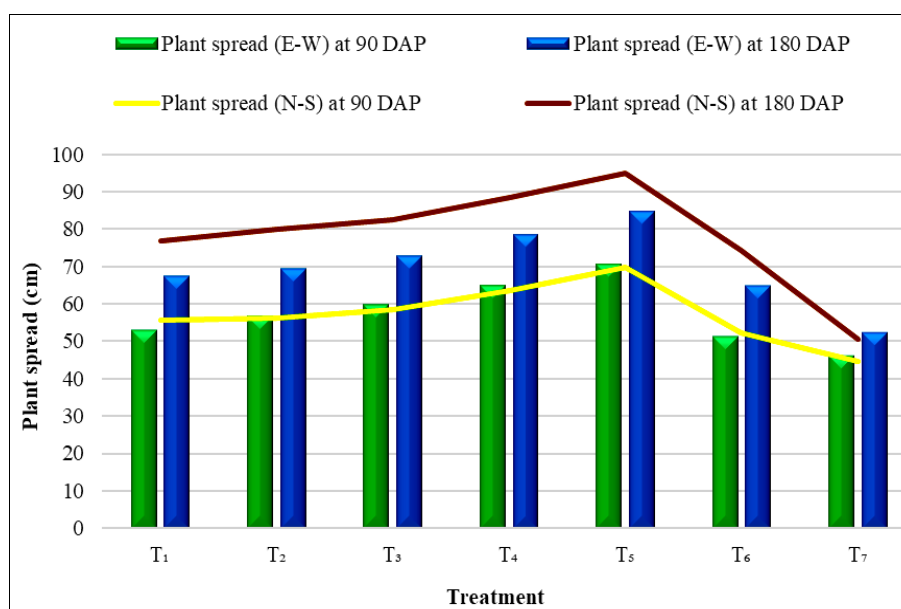


Fig 3: Plant spread (E-W and N-S) in Floribunda rose cv. Mirabel as influenced by different fertigation level

Flowering parameters

Varying fertilizer levels applied through fertigation significantly influenced the flowering behaviour of floribunda rose cv. Mirabel. The minimum number of days required for bud initiation (24.22 days), 50 per cent flowering (27.84 days) and complete flower opening (32.45 days) was recorded with T₅ (175% RDF; 87.5:87.5:131.25 g NPK/plant/year through fertigation) shown in (Figure 4). Enhanced nutrient availability through fertigation improved root-zone conditions, ensuring efficient uptake and utilization of NPK. Increased nutrient assimilation augmented photosynthetic rate and translocation of

photosynthates toward developing buds, facilitating early floral initiation. Nitrogen contributed to chlorophyll and protein synthesis, phosphorus aided in energy transfer and nucleic acid metabolism, while potassium regulated osmotic balance and enzyme activation. These synergistic effects accelerated floral meristem differentiation and promoted earlier flowering. Similar trends have been reported by Palai *et al.* (2002)^[11] and Qasim *et al.* (2008)^[18] in rose, and Nayak *et al.* (2005)^[9] in gerbera, emphasizing the positive impact of balanced nutrient management under fertigation systems.

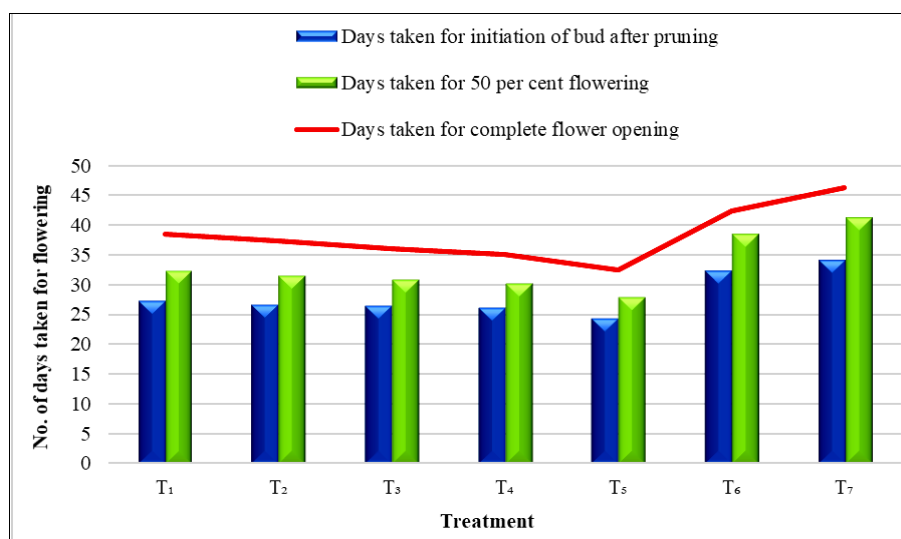


Fig 4: Effect of different fertigation levels on flowering traits of Floribunda rose cv. Mirabel

Conclusion

Balanced fertigation significantly enhances growth and flowering in Floribunda rose cv. Mirabel, with treatment T₅ exhibiting the most pronounced improvements among all fertigation levels surpassing T₆ (100% RDF; 50:50:75 g NPK/plant/year applied through the conventional method). Treatment T₁ (75% RDF; 37.5:37.5:56.25 g NPK/plant/year through fertigation) also showed promising results compared to T₆, confirming the superiority of fertigation, which enhances nutrient delivery, improves resource efficiency by using up to 25 per cent less fertilizer and enables precise control over dosage, timing and concentration to promote crop performance and nutrient uptake.

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