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# EFFECT OF DIFFERENT NUTRITIONAL TREATMENTS ON FLOWERING OF *Fuchsia X Hybrida* CV. 'JOLLIES FLORAC'

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**ABSTRACT**

A greenhouse experiment was carried out to study the effect of different nutritional sources on the flowering of fuchsia for two consecutive years during 2021-2022. Potted plants were placed on benches under the greenhouse condition in a completely randomized design (CRD). There were 13 treatments with three replicates each i.e., Unfertilized control, 75% NPK through chemical fertilizers (Urea, SSP, and MOP), 100% NPK through chemical fertilizers (Urea, SSP, and MOP), 125% NPK through chemical fertilizers (Urea, SSP, and MOP), 75% N through Vermicompost on N equivalence basis, 100% N through Vermicompost on N equivalence basis, 125% N through Vermicompost on N equivalence basis, 75% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%), 100% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%), 125% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%), 75% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%), 100% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%), and 125% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%). Nutritional treatments consisting of 125% NPK through chemical fertilizers (Urea, SSP, and MOP), viz., $T_4$ resulted in an extended duration of flowering (231.22 days) with a maximum number of flowers (131.82) and secondary branches (87.20) per plant. However after two years of planting, nutritional treatments did not have any significant effect on the number of days taken to bud formation or flowering, diameter of petal, diameter of sepal, and length of flower stalk. 125% NPK through chemical fertilization (Urea, SSP, and MOP) resulted in good and long-flowered fuchsias with higher benefit:cost ratio under high hill areas of Himachal Pradesh.

***Key words*:** *Fuchsia x hybrida*, flowering shrub, pot plant, nutritional source, chemical fertilizers, flowering duration

## Introduction

The global flower pots and planters market is estimated to be valued at USD 1.27 billion in 2026 (1.21 billion in 2025) and is expected to reach 1.82 billion by 2033, exhibiting a compound annual growth rate (CAGR) of 5.2% from 2026-2033. North America holds 34.2% of the market share in 2025 and has established itself as the dominant region in the global flower pots and planters market (Doshi, 2026). Cultural perfection for the specific species and cultivar is necessary for the quality production of potted plants (Conover, 1986). One such potential plant is common fuchsia (*Fuchsia* x *hybrida* L.), a popular ornamental pot plant for moderate to cooler temperate areas. Fuchsia holds immense commercial potential for exploitation as an ornamental pot plant. It is a woody ornamental shrub that belongs to the family Onagraceae and is native to South America (Berry, 1982). It is used as an early summer or rainy season potted plant in the hills of temperate Himalayas. Commercial nurserymen and ornamental horticulturists have been producing potted and hanging fuchsias in normal soil-based potting with negligible use of fertilizers, mainly foliar sprays. Growers rely only on the quality of the potting mixture to improve its flowering. It is the normal trend being followed in the

Indian ornamental pot plant industry. To improve the hybrid vigour and to attain optimum output from present-day cultivars of fuchsia, it becomes imperative that proper fertilization should be followed for growing modern-day new hybrids, using different nutrient sources like chemical fertilizers, and organic and natural manures.

Nutrient management is essential for the sustainable production of floricultural plants. Balanced nutrition is essential for obtaining optimum plant growth and higher yield. Over-fertilization or under-fertilization leads to nutritional disorders (Barnes *et al*., 2015). Due to the rising costs of fertilizers, there is a need in the floriculture industry for cost-effective fertilization management systems. Considering the imbalanced use of plant nutrients (from organic and inorganic sources), the ratio of soil to fertilizer application, and the importance of cultivating this crop; the most optimum nutritional treatment was worked out for enhancing the growth and flowering of potted fuchsia (*Fuchsia* × *hybrida*) cv. 'Jollies Florac'. Flowers of this variety are double (with many layers of petals), large, with white tube/sepals and lavender-coloured corolla. It has a trailing growth habit. This experiment aimed to provide information regarding the compatible nutrient source and its optimum supply range for optimal plant growth and flowering of *Fuchsia* × *hybrida*.

## Materials and methods

The investigation was carried out for two consecutive years 2021 and 2022 at the Regional Horticultural Research and Training Station, Mashobra-Shimla of Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni-Solan (H.P.), which comes under Agro-ecological Zone III (Wet temperate high hills zone) of Himachal Pradesh. It is located at 31.15° N latitude and 77.21° E longitude, northwest of Shimla city, and at an elevation of 2286 m above mean sea level. The experiment was conducted under naturally ventilated glasshouse conditions in a completely randomized design, with thirteen different nutritional treatments and each was replicated three times. Nutritional treatments used were:

$T_1$ : Unfertilized control

$T_2$ : 75% NPK through chemical fertilizers (Urea, SSP, and MOP)

$T_3$ : 100 % NPK through chemical fertilizers (Urea, SSP, and MOP)

$T_4$ : 125% NPK through chemical fertilizers (Urea, SSP, and MOP)

$T_5$ : 75% N through Vermicompost on N equivalence basis

$T_6$ : 100% N through Vermicompost on N equivalence basis

$T_7$ : 125% N through Vermicompost on N equivalence basis

$T_8$ : 75% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%)

$T_9$ : 100 % N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%)

$T_{10}$: 125% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%)

$T_{11}$: 75% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%)

$T_{12}$: 100% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%)

$T_{13}$: 125% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%)

**Experimental layout**

4-5 node terminal cuttings were collected from the tip of the shoots downward. A well-rooted cutting with 2-4 pairs of leaves with an average length of 10-15 cm formed a propagule (Wilson, 1965; Roberts *et al*., 1990; Wazir, 2015). The well-rooted and well-graded quality cuttings were transplanted (spring potting) during April 2021, one plant per 6-inch diameter pot (1 L pot volume). During the second year, a large fraction of roots became 'pot bound'; therefore same plants were re-potted during March 2022 into bigger sized 10-inch plastic pots (6 L pot volume) to ensure unrestricted growth. Pots were placed at pot-to-pot distance depending on plant vigour in 39 sections (10 pots/ section) on raised benches as per the design of the experiment. The particular section represented a particular treatment and its particular replication. Due to nutrient limitations in the small pot during the second year, repotting was done after a few days of pruning. They were watered well and kept in the shade for a few days before final placement in the glasshouse.

**Fertilization strategies**

Fuchsia being a perennial plant requires regular nutrient feeding at the time of pruning, plant growth, and flowering. Farmyard manure was applied before planting as potting mixture i.e., Sand: Soil: FYM (1:1:1; v/v). Macronutrients ($N/P_2O_5/K_2O$) were applied in high proportions at the rate of 450, 450, and 625 mg per liter pot content, respectively (Penningsfeld, 1972). The control treatment was not fertilized. Inorganic fertilizers (SSP and MOP), organic manure (vermicompost), and natural manure (ghanjeevamrit) were incorporated into the soil

**Table 1:** Effect of nutritional treatments on number of days taken to bud formation, number of days taken to flowering and duration of flowering (days) in *Fuchsia* × *hybrida* cv. 'Jollies Florac'.

| | Nutritional treatments | DTBF | | DTF | | DF | |
|---|---|---|---|---|---|---|---|
| | | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 |
| $T_1$ | Unfertilized control | 98.80 | 41.93 | 113.13 | 64.40 | 132.87 | 191.60 |
| $T_2$ | 75% NPK through chemical fertilizers (Urea, SSP, and MOP) | 89.33 | 41.07 | 104.47 | 60.47 | 160.87 | 221.87 |
| $T_3$ | 100 % NPK through chemical fertilizers (Urea, SSP, and MOP) | 84.93 | 37.67 | 102.33 | 60.11 | 166.67 | 226.56 |
| $T_4$ | 125% NPK through chemical fertilizers (Urea, SSP, and MOP) | 84.87 | 37.46 | 101.60 | 57.44 | 170.73 | 231.22 |
| $T_5$ | 75% N through Vermicompost on N equivalence basis | 94.27 | 41.20 | 108.73 | 63.80 | 142.93 | 207.87 |
| $T_6$ | 100% N through Vermicompost on N equivalence basis | 92.96 | 41.80 | 107.49 | 62.27 | 149.51 | 210.40 |
| $T_7$ | 125% N through Vermicompost on N equivalence basis | 92.87 | 40.27 | 106.50 | 63.60 | 154.50 | 210.07 |
| $T_8$ | 75% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%) | 92.93 | 41.27 | 107.13 | 62.47 | 151.20 | 214.53 |
| $T_9$ | 100 % N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%) | 92.84 | 40.20 | 105.93 | 61.67 | 157.07 | 217.67 |
| $T_{10}$ | 125% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%) | 90.51 | 40.07 | 105.47 | 60.40 | 158.87 | 221.93 |
| $T_{11}$ | 75% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%) | 91.00 | 40.07 | 105.73 | 61.40 | 158.60 | 219.60 |
| $T_{12}$ | 100% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%) | 86.93 | 39.27 | 104.46 | 60.00 | 162.88 | 225.67 |
| $T_{13}$ | 125% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%) | 85.93 | 39.00 | 103.60 | 59.20 | 165.40 | 226.47 |
| | C.D.0.05 | 4.74 | NS | 5.14 | NS | 6.06 | 6.85 |
| | DTBF: Days taken to bud formation; DTF: Days taken to flowering; DF: Duration of flowering (days) | | | | | | |

surface after four weeks of transplanting when the plants were established. Urea was top-dressed in two equal splits with intervals of four weeks after potting. Each source of nutrient was supplied at three rates 75%, 100%, and 125% by weight; on a nitrogen equivalence basis as nitrogen is a critical element for plant growth. Standard cultural practices were followed during the investigation.

## Results and discussion

### Duration of flowering, days taken to bud formation and flowering

The number of days taken to first flowering was recorded from the date of potting till the anthesis of the first five flowers on each plant (Tangeras, 1979) (Table 1). Among different treatments evaluated during the first year of the experiment, the earliest bud formation (84.87 days) and flowering (101.60 days) occurred in nutritional treatment consisting of 125% NPK through chemical fertilizers (Urea, SSP, and MOP) i.e., $T_4$. The improved performance after chemical treatments during the first year of growth was ascribed to the enhanced and effective nutrient absorption by plants, resulting in proper food translocation and earlier bud formation. The rapid mineralization of nutrients from chemical fertilizers in the substrate increased the availability of macronutrients in soil, particularly phosphorus and potassium. In Fig. 1 the

**Table 2:** Effect of nutritional treatments on number of flowers per plant, diameter of petal (cm) and diameter of sepal (cm) in *Fuchsia x hybrida* cv. 'Jollies Florac'.

| | Nutritional treatments | NFP | | DP | | DS | |
|---|---|---|---|---|---|---|---|
| | | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 |
| $T_1$ | Unfertilized control | 28.67 | 72.73 | 2.86 | 2.47 | 9.91 | 9.26 |
| $T_2$ | 75% NPK through chemical fertilizers (Urea, SSP, and MOP) | 32.87 | 127.13 | 2.86 | 2.53 | 9.94 | 9.59 |
| $T_3$ | 100 % NPK through chemical fertilizers (Urea, SSP, and MOP) | 41.07 | 129.16 | 2.99 | 2.49 | 10.26 | 9.79 |
| $T_4$ | 125% NPK through chemical fertilizers (Urea, SSP, and MOP) | 42.00 | 131.82 | 2.93 | 2.56 | 10.41 | 9.71 |
| $T_5$ | 75% N through Vermicompost on N equivalence basis | 32.80 | 73.53 | 2.88 | 2.53 | 10.15 | 9.87 |
| $T_6$ | 100% N through Vermicompost on N equivalence basis | 32.40 | 83.53 | 2.99 | 2.57 | 10.27 | 9.81 |
| $T_7$ | 125% N through Vermicompost on N equivalence basis | 35.47 | 86.16 | 3.03 | 2.69 | 10.51 | 9.94 |
| $T_8$ | 75% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%) | 36.00 | 82.75 | 2.99 | 2.60 | 10.43 | 9.82 |
| $T_9$ | 100 % N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%) | 36.27 | 82.84 | 3.00 | 2.61 | 10.49 | 9.91 |
| $T_{10}$ | 125% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%) | 37.20 | 95.47 | 3.00 | 2.63 | 10.68 | 9.91 |
| $T_{11}$ | 75% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%) | 30.27 | 75.75 | 2.95 | 2.59 | 10.45 | 9.88 |
| $T_{12}$ | 100% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%) | 32.07 | 86.80 | 3.08 | 2.64 | 10.50 | 9.92 |
| $T_{13}$ | 125% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%) | 40.53 | 88.71 | 3.17 | 2.72 | 10.74 | 10.01 |
| C.D.0.05 | | 4.39 | 13.26 | NS | NS | NS | NS |
| NFP: Number of flowers per plant; DP: Diameter of petal (cm); DS: Diameter of sepal (cm) | | | | | | | |

effect of nutritional treatments on available phosphorus and potassium (kg ha$^{-1}$) in growing media for cultivation of fuchsia cv. 'Jollies Florac' is depicted. Phosphorus has a significant function in the commencement of floral primordial creation (Sharma *et al*., 2010; Choudhary *et al*., 2022) and the yield increased significantly in fuchsia after potassium nutrition. These increases in flowering parameters with higher doses of fertilizers are in close conformity with the findings of Sharma *et al*., (2010), Sharma *et al*., (2013), Singh *et al*., (2015) and Nair *et al*., (2020). Delayed bud formation and flowering in organic treatments might be due to the vigorous vegetative growth of the plants. This treatment showed an increased duration of flowering (170.73 days and 231.22 days during 2021 and 2022, respectively) which lasted five to six weeks longer than unfertilized plants (control). The minimum duration of flowering (132.87 days and 191.60 days) along with a maximum number of days taken to bud formation (98.80 days and 41.93 days) and flowering (113.13 days and 64.40 days) was observed in $T_1$.

**Number of flowers per plant, diameter of petal (cm) and diameter of sepal (cm)**

Nutritional treatment consisting of 125% NPK through chemical fertilizers (Urea, SSP, and MOP) i.e., $T_4$ resulted in the maximum number of flowers per plant after 8 and 20 months of planting (42.00 and 131.82, respectively) (Table 2). The minimum number of flowers per plant (28.67 and 72.73) was observed in $T_1$. Increasing the level of nutrients increased the number of secondary branches thus increasing the number of flowers per plant. The application of water-soluble forms of nutrients (Urea, SSP, and MOP) under chemical treatments lead to enhanced availability of optimal dosages in an accessible form, higher nutrient absorption, quicker transfer of assimilates from source to sink, increased photosynthetic activity and higher accumulation of photosynthates in plants (Singh *et al*., 2017; Nair *et al*., 2020; Choudhary *et al*., 2022). The diameter of petals and sepals were better than control. Plants that received organic treatments bear flower in lesser numbers as compared to chemical treatments (Kim, 1995). Generally, more vegetative growth ensured more flowering in fuchsias.

**Length of flower stalks (cm), plant size (cm) and number of secondary branches per plant**

During 2021, nutritional treatments consisting of 125% NPK through chemical fertilizers (Urea, SSP, and MOP) i.e., $T_4$ resulted in maximum length of flower stalk (5.89 cm) (Table 3). The minimum length of the flower stalk was observed in the case of $T_1$ (4.58 cm). The data depicted that nutritional treatments had a significant effect

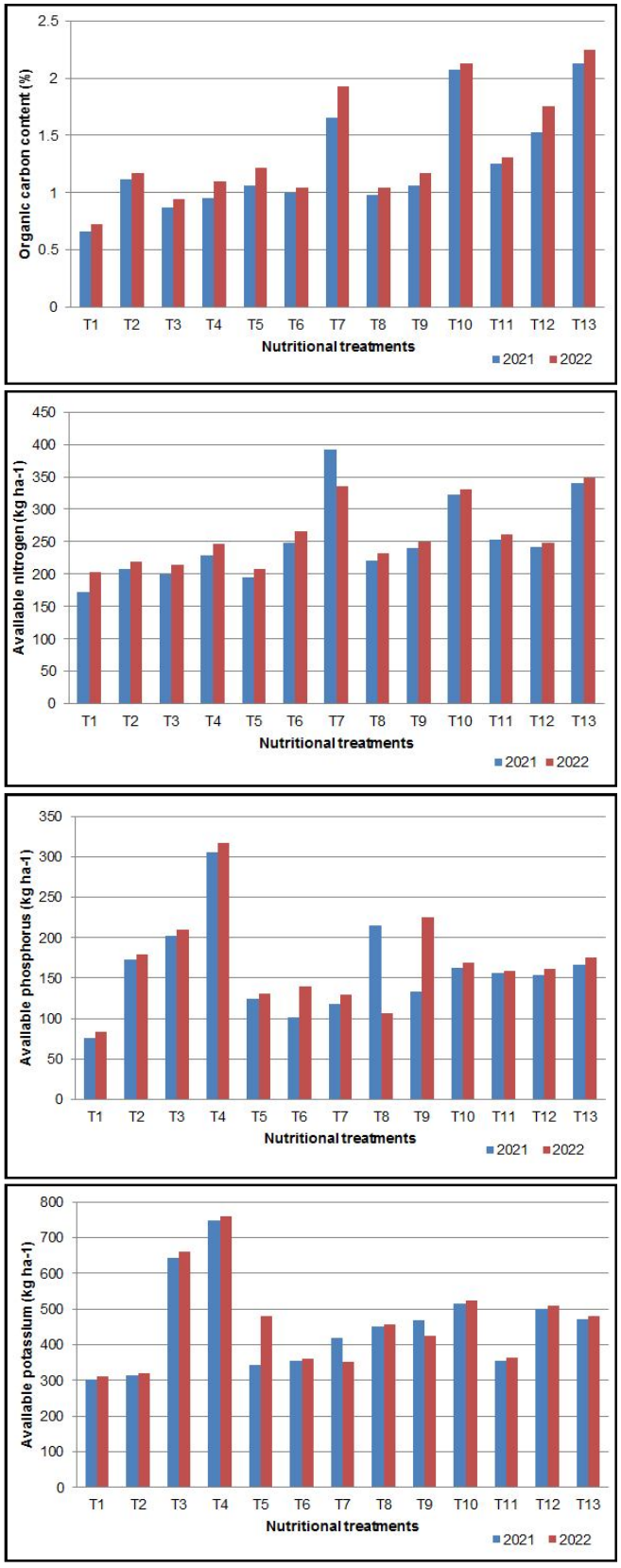



**Fig. 1:** Effect of nutritional treatments on organic carbon content (%), available nitrogen (kg ha$^{-1}$), available phosphorus (kg ha$^{-1}$) and available potassium (kg ha$^{-1}$) in growing media for cultivation of fuchsia cv. 'Jollies Florac'.

**Table 3:** Effect of nutritional treatments on length of flower stalk (cm), plant size (cm) and number of secondary branches per plant in *Fuchsia x hybrida* cv. 'Jollies Florac'.

| | Nutritional treatments | LFS | | PS | | NSBP | |
|---|---|---|---|---|---|---|---|
| | | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 |
| $T_1$ | Unfertilized control | 4.58 | 3.61 | 44.29 | 57.85 | 40.90 | 50.37 |
| $T_2$ | 75% NPK through chemical fertilizers (Urea, SSP, and MOP) | 5.15 | 4.26 | 48.47 | 63.44 | 47.47 | 69.80 |
| $T_3$ | 100 % NPK through chemical fertilizers (Urea, SSP, and MOP) | 5.15 | 4.43 | 44.71 | 66.23 | 52.33 | 82.73 |
| $T_4$ | 125% NPK through chemical fertilizers (Urea, SSP, and MOP) | 5.89 | 4.68 | 47.18 | 65.36 | 55.93 | 87.20 |
| $T_5$ | 75% N through Vermicompost on N equivalence basis | 5.07 | 4.20 | 47.39 | 65.36 | 43.00 | 60.27 |
| $T_6$ | 100% N through Vermicompost on N equivalence basis | 4.61 | 4.23 | 50.34 | 64.13 | 44.07 | 75.53 |
| $T_7$ | 125% N through Vermicompost on N equivalence basis | 4.78 | 4.33 | 52.56 | 66.35 | 43.78 | 56.10 |
| $T_8$ | 75% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%) | 5.36 | 3.75 | 47.53 | 63.95 | 52.97 | 63.83 |
| $T_9$ | 100 % N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%) | 5.46 | 3.85 | 50.98 | 67.05 | 52.70 | 52.36 |
| $T_{10}$ | 125% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (10%) | 5.52 | 3.92 | 56.18 | 68.75 | 46.17 | 64.07 |
| $T_{11}$ | 75% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%) | 4.95 | 4.07 | 51.70 | 67.30 | 40.93 | 63.48 |
| $T_{12}$ | 100% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%) | 4.87 | 3.91 | 54.77 | 70.47 | 41.80 | 56.80 |
| $T_{13}$ | 125% N through Ghanjeevamrit on N equivalence basis + Jeevamrit (15%) | 5.29 | 3.94 | 56.06 | 72.66 | 47.84 | 66.50 |
| | C.D.0.05 | 0.71 | NS | 5.13 | 4.76 | 8.64 | 14.58 |

LFS: Length of flower stalk (cm); PS: Plant size (cm); NSBP: Number of secondary branches per plant

on plant size during both years. Nutritional treatments consisting of 125% N through Ghanjeevamrit on an N equivalence basis + Jeevamrit (10%) i.e., $T_{10}$ and 125% N through Ghanjeevamrit on an N equivalence basis + Jeevamrit (15%) i.e., $T_{13}$ resulted in maximum plant size (56.18 cm and 72.66 cm) after 8 and 20 months of planting, respectively. The minimum plant size after 8 and 20 months of planting was found in $T_1$ (44.29 cm and 57.85 cm, respectively). In Fig. 1 the effect of nutritional treatments on organic carbon content (%) and available nitrogen (kg $ha^{-1}$) in growing media for cultivation of fuchsia cv. 'Jollies Florac' is depicted. Increased organic carbon content (%) and available nitrogen (kg $ha^{-1}$) levels in nutritional treatments containing ghanjeevamrit enhanced vegetative growth. Spraying the plants with jeevamrit at 15-day intervals stimulated shoot elongation and enhanced plant growth efficiency. It was at the expense of this lush green vegetative growth with nutritional variants containing ghanjeevamrit and foliar sprays of jeevamrit, they flowered lesser in number as well as duration compared to chemical treatments (Barad *et al*., 2011; Sharma *et al*., 2013; Polara *et al*., 2015). Increased duration of crop cycle (perennial nature of plant growth) and larger container/substrate volume during the second year naturally resulted in an increased relative growth rate compared to the first year. During 2021 and 2022, nutritional treatment $T_4$ resulted in maximum number of secondary branches per plant (55.93 and 87.20) after 8 and 20 months of planting, respectively. The minimum number of secondary branches per plant after 8 and 20 months of planting was found in $T_1$ (40.90 and 50.37, respectively). Repotting in larger pots increased the total nutrient content, water-holding capacity and oxygen availability of containers, thereby increasing the rate of photosynthesis and growth of plants (Poorter *et al*., 2012).

## Conclusion

Evaluation of plants for two consecutive years suggested that the nutritional variant $T_4$ resulted in an extended duration of flowering with the maximum number of flowers and secondary branches per plant. This treatment could be considered at par for parameters like the number of days taken to bud formation or flowering, diameter of petal, diameter of sepal, and length of flower stalk. Chemical fertilization ($T_4$) i.e., 125% NPK dose through urea, single superphosphate and muriate of potash ensured abundant and long flowering fuchsias under mid-high hill areas of Himachal Pradesh.

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