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# Effect of Biostimulants on Growth, Flowering and Yield of Rose (*Rosa chinensis* L.) cv. Ganganagri Rose

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***Abstract***— *Study on Effect of Biostimulants on Growth, Flowering and Yield of Rose (Rosa chinensis L.) cv. Ganganagri Rose was conducted at Horticulture Farm, Department of Horticulture, Rajasthan College of Agriculture, Udaipur, Rajasthan during October 2024 to March 2025. The result indicated that among the treatment plant sprayed $T_7$ 75% RDF + IIHR Arka microbial consortium + Humic acid @ 3 ml/litre was recorded significantly maximum plant height (63.46 cm), number of leaves plant$^{-1}$ (270.92), plant spread-North to South direction (49.40 cm), plant spread East to West direction (55.10 cm), number of flowering shoot (9.75) and shoot length at first flower bud appearance (26.41 cm). minimum number of days to first flower bud appearance (38.00 days), days to flowering (55.00 days) and highest duration of flowering (114.08 days), flower diameter (6.60 cm), flower weight (5.55 g), total number of flowers plant$^{-1}$ (116.17), flower yield plant$^{-1}$ (644.74 g), flower yield plot$^{-1}$ (2.58 kg), flower yield ha$^{-1}$ (6.45 t/ha) and shelf life of loose flowers (4.00 days). Thus, combined application of bio-stimulant could be considered as a suitable treatment for enhanced growth, flowering, yield and quality of rose.*

***Keywords***— ***Rose, humic acid, arka microbial consortium, fulvic acid, jeeevamrit, sea weed extract***

## I. INTRODUCTION

Rose (*Rosa chinensis* L.) belongs to the family Rosaceae and it has 2n=14 chromosomes and it has basic chromosome number (X=12). Rose plants need complete exposure to sun rays; hence shady areas are not at all suitable. The ideal temperature for the growth and good yield for rose flowers is 18-30°C and the pH of the soil should range from 6-7.5. Rose plants are sensitive to waterlogging and hence, a proper drainage system should be maintained. It can grow well at rainfall of 200-300 mm. Sandy loam, red loam, silt loam with good water holding capacity is ideal for rose cultivation. They are used for different purposes as pot plant, garden plant, cut and loose flower production (Sumangala *et al*.,2019).

The rose has been loved and cherished from very ancient times. In modern age, its importance becomes still greater because rose breeders have been increasing its range of colors while at the same time adding valuable characters like disease resistance and a longer period of flowering. It is a versatile plant and has wide variability is one of the reasons for its great popularity. The rose, because of its utility, occupies a prominent, place amongst the flower crops. It has beautiful flowers of exquisite shape, different sizes, colors and most delightful fragrance that has made it an important flower or its varied uses.

Bio-stimulants have been gaining interest in sustainable agriculture because their application activates several physiological processes that enhance nutrient use efficiency, stimulating plant development (Kunicki *et al*., 2010). Bio-stimulants are among the natural preparations that improve the general health, vitality and growth of plants and protect them against infections. The word bio-stimulants were first defined by Kauffman *et al*., (2007)

with modifications as 'Bio-stimulants are materials, other than fertilizers, that promote plant growth when applied in low quantities.' The word bio-stimulants were increasingly used by the scientific literature over the following years, expanding the range of substances and of modes of actions (Calvo *et al*., 2014; Du Jardin, 2012; Halpern *et al*., 2015). The main active substances used in such preparations are humic and fulvic acids, compounds containing nitrogen, seaweed extracts, beneficial fungi and bacteria. Many groups of bio stimulants have been distinguished through their method of application (soil or foliar), the material from which they were produced (plant or animal). Arka Microbial Consortium (AMC) is a carrier-based product released from IIHR, Bengaluru is recommended for media preparation, seed treatment and soil application. Jeevamrit is a natural liquid fertilizer made by fermenting a mixture of cow or buffalo dung, urine, mud and food.

## II. MATERIALS AND METHODS

The present research work entitled "Effect of Biostimulants on Growth, Flowering and Yield of Rose (*Rosa chinensis* L.) cv. Ganganagri Rose" was conducted with twelve treatment combinations comprised of foliar spray *i.e*., $T_1$ - Control, $T_2$ - 100% RDF (200:120:120 kg/ha NPK), $T_3$ - 75% RDF + IIHR Arka microbial consortium (AMC) @ 20 g/litre, $T_4$ - 50% RDF + IIHR Arka microbial consortium (AMC) @ 20 g/litre, $T_5$ - 75% RDF + IIHR Arka microbial consortium + Fulvic acid @ 3 ml/litre, $T_6$ - 50% RDF + IIHR Arka microbial consortium + Fulvic acid @ 3 ml/litre, $T_7$ - 75% RDF + IIHR Arka microbial consortium + Humic acid @ 3 ml/litre, $T_8$ - 50% RDF + IIHR Arka microbial consortium + Humic acid @ 3 ml/litre, $T_9$ - 75% RDF + IIHR Arka microbial consortium +Sea weed extract (IFFCO Sagarika) @ 3 ml/litre, $T_{10}$ - 50% RDF + IIHR Arka microbial consortium +Sea weed extract (IFFCO Sagarika) @ 3 ml/litre, $T_{11}$ - 75% RDF + IIHR Arka microbial consortium +Jeevamrit @ 15% $T_{12}$ - 50% RDF + IIHR Arka microbial consortium +Jeevamrit @ 5%were evaluated with three replications under randomized block design. The growth parameters of the rose were recorded at 15, 30 and 45 days after pruning (DAP) and flowering parameters were recorded at 45 days after pruning with 3 replications in Randomized Block Design (RBD).

### 2.1 Experimental site

The experiment for the research work was conducted during the year 2024- 2025 at the Horticulture Farm, Department of Horticulture, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur. This region falls under agro-climatic zone IV a, *i.e*. "Sub-humid Southern Plain and Aravalli Hills of Rajasthan" at an altitude of 562.8 meters above mean sea level, at $24^0$ 35' N latitude and $74^0$42' E longitude. The experiment was conducted in clay loam soil under irrigated condition.

### 2.2 Climatic and weather conditions

Udaipur comes under typical sub-tropical climatic condition, *i.e.* both winters and summers are experienced in this region at their appropriate time. The average rainfall ranges from 760 to 900 mm per year. More than 90 percent rainfall is received during mid-June to September with scanty showers during winter months.

### 2.3 Details of field operations

#### 2.3.1 Preparation of field

The field was prepared by spade and dutch hoe to a fine tilth. Since the plants were already planted in the field they were not disturbed. The root stubbles, grass residues and other unwanted plant residues were removed from the rest part of the field. Planking was done here after. The soil around the plants was removed and the roots were exposed to sunlight for two days during first week of October 2024 after monsoon rain. Thereafter the plants were pruned 30 cm above ground level and suitable organic manures and fertilizers were incorporated in the soil as basal application. The roots around the plants were filled with FYM @ 30 tonnes/hectare and covered with soil. The plants were arranged according to the spacing provided.

#### 2.3.2 Pruning

Before imposing treatments, the plants were lightly pruned lightly on 15th October, 2024 at 30 cm above the ground, keeping four primary shoots in each plant for uniform growth and development. The cut ends were pasted with blitox immediately after pruning to protect the plants from dieback and other fungal diseases. Immediately after the pruning, plants were applied with chemical fertilizers as per the package of practices.

#### 2.3.3 Fertilizer application

Rose is a perennial crop, it requires continual nutrient feeding through manures and fertilizers during plant growth and flowering, in addition to these nutrients supplied during field preparation and planting. Nitrogen was applied in the form of urea (46%), phosphorus in the form of SSP (16%) and potash in the form of muriate of potash (60%) as per treatment.

#### 2.3.4 Weeding

Weeds were the major problem noticed in field. However, the field was kept free from weeds by manual weeding as and when it is required.

### 2.3.5 Source of irrigation

The main source of irrigation was a Drip irrigation set. The plants were only watered at the root area. Rest of the area was not watered; this was done through a small pipe. Irrigation was provided at an interval of 10 days either in the morning or in the afternoon.

### 2.3.6 Plant protection

No major pests and diseases were observed in rose during crop period. Although the termite was seen but it was controlled by application of chlorpyrifos (durmet) 20% EC@ 20 ml/10 lit of water.

### 2.3.7 Harvesting of flowers

Fully opened flowers were harvested by hand plucking in the morning hours, which were weighed and number of flowers was counted immediately.

## III. RESULTS AND DISCUSSION

### 3.1 Plant height (cm)

The plant height recorded at 15, 30 and 45 days after pruning (DAP) as significantly influenced by bio-stimulants were presented in Table: 3.1. Among different treatments, maximum plant height (43.10 cm, 51.68 cm and 63.46 cm) at 15 DAP, 30 DAP and 45 DAP, respectively) was recorded with $T_7$ (75% RDF + IIHR Arka microbial consortium + Humic acid @ 3ml/litre), followed by $T_9$ (75% RDF + IIHR Arka microbial consortium + sea weed extract (IFFCO Sagarika @ 3ml/litre) having values of 42.20 cm, 51.24 cm 62.11 cm at 15 DAP, 30 DAP and 45 DAP, respectively. While the lowest plant height of 37.34 cm, 44.37 cm and 52.89 cm was recorded under $T_1$ (control) at 15 DAP, 30 DAP and 45 DAP, respectively. Similar results regarding the effect of humic acid on plant height were also reported by Sankari *et al*. (2015) and Pradeep *et al*. (2014) in gladiolus.

### 3.2 plant spread - North to South direction (cm)

The plant spread in North-South direction as influenced by foliar application of bio-stimulants on Rose (*Rosa chinensis* L.) cv. Ganganagri rose at different stages of plant growth at 15, 30 and 45 DAP were presented in Table: 3.1. At 15 DAP, the maximum plant spread (34.58 cm) was recorded in the treatment $T_7$ (75% RDF + IIHR Arka microbial consortium + Humic acid @ 3 ml/litre) and minimum plant spread (28.60 cm) was observed in $T_1$ (control). At 30 and 45 DAP, the similar trend was noticed with respect to plant spread in North-South direction. The maximum plant spread (40.93 and 49.40 cm respectively) was noticed in treatment $T_7$ (75% RDF + IIHR Arka microbial consortium + Humic acid @3 ml/litre) which was statically on par with $T_8$ (75% RDF + IIHR Arka microbial consortium + Humic acid @3 ml/litre) with values of 39.48 and 48.72 cm, respectively and minimum plant spread (34.14 and 42.08 cm) was observed in $T_1$ (control). Similar results regarding the effect of humic acid on plant height were also reported by Mohammadipour *et al*. (2012) in marigold.

### 3.3 Plant spread- East to West direction (cm)

The data recorded on the plant spread in East-West direction at 15, 30 and 45 DAP were presented in Table: 3.1. At 15 DAP, the maximum plant spread (37.81 cm) was recorded in the treatment $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre) and minimum plant spread (32.80 cm) was observed in $T_1$ (control). At 30 and 45 DAP, the similar trend was noticed with respect to plant spread in East-West direction. The maximum plant spread (45.17 and 55.10 cm respectively) was noticed in treatment $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre) which was statically on par with $T_9$ (75% RDF + IIHR Arka microbial consortium + sea weed extract (IFFCO Sagarika @ 3ml/litre) (44.43 and 53.23 cm respectively) and minimum plant spread (39.21 and 46.60 cm, respectively) was observed in $T_1$ (control). Similar results regarding the effect of humic acid on plant height were also reported by Mohammadipour *et al*. (2012) in marigold.

### 3.4 Number of leaves plant$^{-1}$

An appraisal of data in Table 3.2 shows that number of leaves plant$^{-1}$ in rose significantly influenced with the application of different foliar application of bio-stimulants during the experimentation. Maximum number of leaves plant$^{-1}$(138.00,189.08 and 270.92 leaves) were recorded for the treatment $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre), followed by $T_9$ (75% RDF + IIHR Arka microbial consortium + sea weed extract (IFFCO Sagarika@ 3ml/litre) having values of 136.08, 184.42 and 267.52 leaves, respectively. While minimum leaves plant$^{-1}$ *i.e*. 118.83, 166.75 and 236.33 leaves were observed under the treatment $T_1$ (control) at 15 DAP, 30 DAP and at 45 DAP, respectively. This result has also been reported by Bohme and Papadopoulos (1999).

### 3.5 Number of flowering shoots plant$^{-1}$

The data on the number of flowering shoot plant$^{-1}$ as influenced significantly by foliar application of bio-stimulants concentration on rose (*Rosa chinensis* L.) cv. Ganganagri rose are presented in Table 3.2. The highest number of flowering shoot plant$^{-1}$ 9.75 was observed in the treatment $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre) followed by $T_9$ (75% RDF + IIHR Arka microbial consortium + sea weed extract (IFFCO Sagarika @ 3ml/litre) (9.53 shoots) at 45 DAP. However, it was lowest (8.63) in $T_1$ (control), which was significantly

inferior over all other treatments. There is an increase of 13% from minimum to maximum number of flowering shoot plant$^{-1}$ parameter). These results are supported by the findings of Gaurav *et al*. (2016) in African marigold.

### 3.6 Shoot length at first flower bud appearance (cm)

Shoot length at first flower bud appearance data presented in Table 3.2. Maximum shoot length at first flower bud appearance *i.e*., 26.41 cm was recorded under the treatment $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre) which was statistically at par with $T_8$ (75% RDF + IIHR Arka microbial consortium + Humic acid @3 ml/litre) with value 25.94 cm, $T_9$ (75% RDF + IIHR Arka microbial consortium + sea weed extract (IFFCO Sagarika @ 3ml/litre) having value of 25.75 cm. while minimum shoot length at first flower bud appearance 24.04 cm were observed under the treatments $T_1$ (control). These results are supported by the findings of Bhargavi *et al*. (2018) in chrysanthemum.

### 3.7 Days to flower bud appearance

The data on the number of days to flower bud appearance as influenced significantly by foliar application of bio-stimulants concentration on rose (*Rosa chinensis* L.) cv. Ganganagri rose are presented in Table 3.3. The plants treated with $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre) and $T_9$ (75% RDF + IIHR Arka microbial consortium + sea weed extract (IFFCO Sagarika @ 3ml/litre) reported minimum number of days (38.00 and 39.83 days) for flower bud appearance and it was delayed by 7 to 8 days $T_{11}$ (75% RDF + IIHR Arka microbial consortium + Jeevamrit @15%) and $T_1$ (control). The results were supported by Azza *et al.* (2012) in chrysanthemum, Pritam *et al*. (2010) in marigold.

### 3.8 Days to flowering

The number of days taken for flowering was significantly by foliar application of bio-stimulants in Table 3.3. The range was between 55 to 65 days. Flowering was advanced (55.00 days) in treatment $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre) followed by $T_9$ (75% RDF + IIHR Arka microbial consortium + sea weed extract (IFFCO Sagarika @ 3ml/litre) (56.83 days) and it was delayed in control $T_1$(65.33 days). The results were supported by Bhargavi *et al.* (2018) in chrysanthemum, Shinde *et al*. (2010) in marigold.

### 3.9 Flower diameter (cm)

It is apparent from the Table 3.3, graphically illustrated in Fig.4.7 that, the flower diameter was significantly influenced by application of bio-stimulants. The biggest flower diameter of 6.60 cm was observed in the treatment treatments $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre) followed by $T_9$ (75% RDF + IIHR Arka microbial consortium + sea weed extract (IFFCO Sagarika @ 3ml/litre) (6.53 cm) at 45 DAP. However, it was lowest (6.10 cm) in $T_1$ (control), which was significantly inferior over all other treatments. The results of present study are well supported by Niyokuri *et al*. (2017) in carnation.

### 3.10 Shelf life (days)

The data with regard to shelf life of flowers is presented in Table 3.3. The shelf life varied significantly among different treatments and it was ranged from 2.75 days to 4.00 days. The maximum shelf life of 4.00 days was recorded in the treatments $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre) followed by $T_8$ (50% RDF + IIHR Arka microbial consortium + Humic acid @ 3 ml/litre) with value 3.76. the minimum shelf life of 2.75 days was recorded in the treatment T1 (control). Similar findings have also been reported by Nikbakht *et al*. (2008) in gerbera.

### 3.11 Flowering duration (days)

After first pruning, rose (*Rosa chinensis* L.) cv. Ganganagri rose grown vigorously and bloom throughout the period of experimental period as presented in Table 3.3. The maximum duration of flowering (114.08 days) was recorded in the treatment $T_7$ *i.e*. 75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre followed by treatment $T_8$ (50% RDF + IIHR Arka microbial consortium + Humic acid @ 3 ml/litre) with value113.12. the minimum flowering duration was observed in treatment $T_1$ (control) with 104.48 value, which was significantly inferior over all other treatments. Same was observed by Praveen *et al*. (2021) in rose.

### 3.12 Flower weight (g)

It is apparent from the Table: 3.3 that, the flower diameter was significantly influenced by application of bio-stimulants. The highest flower diameter of 5.55 cm was observed in the treatment $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre followed by $T_8$ (75% RDF + IIHR Arka microbial consortium + Humic acid @3 ml/litre) (5.52 cm). However, it was lowest (5.15 cm) in $T_1$ (control), which was significantly inferior over all other treatments. Similar findings have also been reported to increase the fresh and dry weights of crops and ornamental plants Steel *et al.* (1997) in petunia.

### 3.13 Number of flower plant$^{-1}$

The data on number of flowers per plant Table 3.4 indicates the existence of significant differences among different treatments at all stages of harvest. The treatments showed significant differences concerning to the number of flower plant$^{-1}$ at all stages of harvest. The treatments $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid

@3ml/litre) and $T_8$ 75% RDF + IIHR Arka microbial consortium + Humic acid @3 ml/litre (116.17 and 114.77) whereas, lowest number of flowers (107.67) was noticed in the treatment $T_1$ (control). These results are supported by Nikbakht *et al*. (2008) who reported that the treatments of high concentration of HA (500 and 1000 mg/L) increased in the number of gerbera flowers.

**3.14 Flower yield plant$^{-1}$ (g)**

The data shows that there was major variation in cumulative flower yield per plant as influenced by bio-stimulants on rose cv. Ganganagri Rose (Table 3.4). The treatments showed significant differences in relation to the cumulative flower yield per plant. The cumulative flower yield per plant of six months was highest (644.74 g) in $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre) followed by $T_8$ (50% RDF + IIHR Arka microbial consortium + Humic acid @3 ml/litre) (633.53 g) and it was lowest in T15 (control) (554.50 g). Humic acid contains many elements which improve the soil fertility and increasing the contents of soil organic matter and consequently affect plant the growth and yield (Hartwigson and Evans 2000).

**3.15 Flower yield plot$^{-1}$ (kg)**

It is clearly noticed from the Table:3.4 that, cumulative flower yield per plot was ranged from 2.22 to 2.58 kg. The maximum cumulative flower yield per plot (2.58 kg) was recorded with $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre) followed by by $T_8$ (50% RDF + IIHR Arka microbial consortium + Humic acid @3 ml/litre) (2.54 kg). However, it was minimum in $T_1$ (control) (2.22 kg). Similar findings have also been reported by Bangulzai (2013) in zinnia.

**3.16 Flower yield ha$^{-1}$ (t)**

It is clearly noticed from the Table: 3.4 that, cumulative flower yield per hectare was ranged from 5.55 to 6.45 tonnes. The maximum cumulative flower yield per hectare (6.45 tonnes) was recorded with $T_7$ (75% RDF+ IIHR Arka microbial consortium + Humic acid @3ml/litre) followed by by $T_8$ (50% RDF + IIHR Arka microbial consortium + Humic acid @3 ml/litre) (6.34 tonnes). However, it was minimum in $T_1$ (control) (5.55 tonnes). Similar findings have also been reported by Bangulzai (2013) in zinnia.

*Table 3.1: Plant height, Plant spread - North to South (cm) direction Plant spread – East to West (cm) direction as influenced by bio-stimulants in rose (Rosa chinensis) cv. Ganganagri Rose*

| Treatments | Plant height (cm) | | | Plant spread (cm)- NS | | | Plant spread (cm) - EW | | |
|---|---|---|---|---|---|---|---|---|---|
| | 15 DAP | 30 DAP | 45 DAP | 15 DAP | 30 DAP | 45 DAP | 15 DAP | 30 DAP | 45 DAP |
| **$T_1$** | 37.34 | 44.37 | 52.89 | 28.60 | 34.14 | 42.08 | 32.80 | 39.21 | 46.60 |
| **$T_2$** | 38.15 | 47.69 | 56.14 | 29.52 | 35.22 | 43.05 | 33.91 | 40.21 | 48.63 |
| **$T_3$** | 39.31 | 48.08 | 59.48 | 30.90 | 36.80 | 44.97 | 35.51 | 41.79 | 50.40 |
| **$T_4$** | 38.71 | 47.65 | 58.44 | 32.38 | 38.31 | 44.71 | 34.73 | 40.89 | 49.51 |
| **$T_5$** | 39.69 | 49.21 | 60.21 | 30.69 | 37.91 | 46.31 | 35.86 | 42.74 | 50.69 |
| **$T_6$** | 40.58 | 49.79 | 59.08 | 32.78 | 38.55 | 47.00 | 35.10 | 41.50 | 49.90 |
| **$T_7$** | 43.10 | 51.68 | 63.46 | 34.58 | 40.93 | 49.40 | 37.81 | 45.17 | 55.10 |
| **$T_8$** | 41.73 | 50.60 | 61.74 | 33.50 | 39.48 | 48.72 | 36.74 | 43.45 | 52.64 |
| **$T_9$** | 42.20 | 51.24 | 62.11 | 33.52 | 38.93 | 47.71 | 37.16 | 44.43 | 53.23 |
| **$T_{10}$** | 41.14 | 50.21 | 60.98 | 33.00 | 38.94 | 47.59 | 36.40 | 42.13 | 51.60 |
| **$T_{11}$** | 37.69 | 45.46 | 54.67 | 28.96 | 34.72 | 42.55 | 33.39 | 39.74 | 47.89 |
| **$T_{12}$** | 38.31 | 46.59 | 58.07 | 32.10 | 37.68 | 45.76 | 34.29 | 40.70 | 50.05 |
| **SEM (±)** | **0.09** | **0.19** | **0.96** | **0.38** | **0.53** | **0.44** | **0.30** | **0.49** | **0.70** |
| **CD (P=0.05)** | **0.27** | **0.56** | **2.84** | **1.12** | **1.52** | **1.28** | **0.90** | **1.44** | **2.06** |

*Table 3.2: Number of leaves plant$^{-1}$, No. of flowering shoot and Shoot length at first flower bud appearance (cm) as influenced by bio-stimulants in rose (Rosa chinensis) cv. Ganganagri Rose*

| Treatments | Number of leaves plant$^{-1}$ | | | Number of flowering shoot | Shoot length at first flower bud appearance (cm) |
|---|---|---|---|---|---|
| | 15 DAP | 30 DAP | 45 DAP | | |
| $T_1$ | 118.83 | 166.75 | 236.33 | 8.63 | 24.04 |
| $T_2$ | 122.58 | 172.50 | 250.00 | 8.81 | 24.42 |
| $T_3$ | 130.92 | 182.00 | 261.83 | 9.08 | 25.18 |
| $T_4$ | 128.08 | 178.75 | 255.58 | 8.90 | 25.37 |
| $T_5$ | 131.58 | 181.92 | 266.42 | 9.17 | 24.61 |
| $T_6$ | 128.08 | 180.08 | 259.00 | 9.35 | 24.99 |
| $T_7$ | 138.00 | 189.08 | 270.92 | 9.75 | 26.41 |
| $T_8$ | 135.00 | 181.17 | 262.08 | 9.53 | 25.94 |
| $T_9$ | 136.08 | 184.42 | 267.42 | 9.44 | 25.75 |
| $T_{10}$ | 133.25 | 178.25 | 258.92 | 9.26 | 25.56 |
| $T_{11}$ | 124.00 | 171.50 | 242.08 | 8.72 | 24.23 |
| $T_{12}$ | 127.58 | 176.08 | 247.83 | 8.99 | 24.80 |
| **SEM (±)** | **1.17** | **2.61** | **3.10** | **0.16** | **0.32** |
| **CD (P=0.05)** | **3.46** | **7.72** | **9.14** | **0.48** | **0.93** |

*Table 3.3: Days to flower bud appearance, Days to flowering, Flower diameter (cm), Shelf life (days), Flowering duration (days) and Flower weight (g) as influenced by bio-stimulants in rose (Rosa chinensis) cv. Ganganagri Rose*

| Treatments | Days to flower bud appearance | Days to flowering | Flower diameter (cm) | Shelf life (days) | Flowering duration (days) | Flower weight (g) |
|---|---|---|---|---|---|---|
| $T_1$ | 46.33 | 65.33 | 6.10 | 2.75 | 104.48 | 5.15 |
| $T_2$ | 45.17 | 64.00 | 6.18 | 2.95 | 105.36 | 5.22 |
| $T_3$ | 44.46 | 63.41 | 6.23 | 3.25 | 106.83 | 5.37 |
| $T_4$ | 44.58 | 62.58 | 6.31 | 3.05 | 107.14 | 5.30 |
| $T_5$ | 43.50 | 60.50 | 6.44 | 3.36 | 109.00 | 5.33 |
| $T_6$ | 39.92 | 58.91 | 6.36 | 3.56 | 111.16 | 5.44 |
| $T_7$ | 38.00 | 55.00 | 6.60 | 4.00 | 114.08 | 5.55 |
| $T_8$ | 40.33 | 56.83 | 6.49 | 3.76 | 113.12 | 5.52 |
| $T_9$ | 39.83 | 57.33 | 6.53 | 3.66 | 112.33 | 5.48 |
| $T_{10}$ | 42.25 | 59.25 | 6.40 | 3.46 | 110.16 | 5.41 |
| $T_{11}$ | 45.70 | 64.66 | 6.14 | 2.85 | 105.56 | 5.19 |
| $T_{12}$ | 44.17 | 62.16 | 6.27 | 3.15 | 107.16 | 5.26 |
| **SEM (±)** | **0.59** | **0.81** | **0.09** | **0.04** | **1.46** | **0.08** |
| **CD (P=0.05)** | **1.75** | **2.40** | **0.28** | **0.12** | **4.31** | **0.23** |

*Table 3.4: Number of flower plant$^{-1}$, Flower yield plant$^{-1}$(g), Flower yield plot$^{-1}$ (kg), Flower yield ha$^{-1}$(t) as influenced by bio-stimulants in rose (Rosa chinensis) cv. Ganganagri Rose*

| Treatments | Number of flower plant$^{-1}$ | Flower yield plant$^{-1}$ (g) | Flower yield plot$^{-1}$ (kg) | Flower yield ha$^{-1}$(t) |
|---|---|---|---|---|
| $T_1$ | 107.67 | 554.50 | 2.22 | 5.55 |
| $T_2$ | 108.89 | 568.89 | 2.27 | 5.67 |
| $T_3$ | 110.72 | 594.56 | 2.38 | 5.96 |
| $T_4$ | 109.50 | 580.35 | 2.32 | 5.80 |
| $T_5$ | 111.33 | 593.38 | 2.37 | 5.93 |
| $T_6$ | 112.55 | 612.27 | 2.45 | 6.12 |
| $T_7$ | 116.17 | 644.74 | 2.58 | 6.45 |
| $T_8$ | 114.77 | 633.53 | 2.54 | 6.34 |
| $T_9$ | 113.16 | 620.11 | 2.48 | 6.20 |
| $T_{10}$ | 111.94 | 605.59 | 2.42 | 6.06 |
| $T_{11}$ | 108.28 | 561.97 | 2.25 | 5.62 |
| $T_{12}$ | 110.11 | 579.17 | 2.32 | 5.79 |
| **SE(m)±** | 1.51 | 10.44 | 0.04 | 0.09 |
| **CD at 5%** | 4.46 | 30.82 | 0.12 | 0.26 |

## IV. CONCLUSION

On the basis of results obtained in present investigation "Effect of Biostimulants on Growth, Flowering and Yield of Rose (*Rosa chinensis* L.) cv. Ganganagri Rose" it could be concluded that among the different treatments used, treatment $T_7$ (75% RDF + IIHR Arka microbial consortium + Humic acid @ 3 ml/litre) proved to be the best for most of the parameters *viz*., studied Plant height (cm), Plant spread (cm), Number of leaves plant$^{-1}$, Number of flowering shoots plant$^{-1}$, Shoot length at first flower bud appearance (cm), Days to flower bud appearance, Days to flowering, , Flower diameter (cm), Flowering duration (days), Shelf life (days), Number of flowers plant$^{-1}$, Flower yield plant$^{-1}$ (g), Flower yield plot$^{-1}$ (g) and Flower yield ha$^{-1}$ (g). Therefore, to produce and sustain higher yield and quality of rose.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author (s) hereby declares that NO generative AI technologies such as large language models (Chat GPT, COPILOT, etc) and tect-to-image generators have been used during writing or editing of this manuscript.

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## COMPETING INTERESTS

Authors have been declared that no competing interests exits.

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