Journal of Ornamental Horticulture, 28 (1): 41-45, 2025 DOI NO.: 10.5958/2249-880X.2025.00009.9

Effect of biostimulants and biofertilizers on soil properties, plant growth and flowering of rose cv. Rose Sherbet

L. RACHANA and V.K. RAO*

Department of Horticulture, College of Agriculture,
G.B. Pant University of Agriculture & Technology, Pantnagar-263 145, Uttarakhand, India
**Corresponding author's e-mail:* vkraohort@gmail.com

ABSTRACT

The present investigation was carried out at Model Floriculture Centre, G. B. Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar Uttarakhand. The experiment was laid out in RBD with nine treatments *viz.*, T_1 (100% Recommended dose of fertilizers-RDF), T_2 (RDF 75% + Fulvic acid), T_3 (RDF 50% + Fulvic acid), T_4 (RDF 75% + Humic acid), T5 (RDF 50% + Humic acid), T_6 (RDF 75% + Sea weed extract-IFFCO Sagarika), T_7 (RDF 50% + Sea weed extract-IFFCO Sagarika), T_8 (RDF 75% + IIHR- Arka microbial consortium) and T_9 (RDF 50% + IIHR- Arka microbial consortium) and three replications. Among all the treatments plant height (63.53 cm), plant spread (55.57 cm), were found maximum in plants treated with humic acid @ 3 mL L^{-1} and 75% Recommended dose of fertilizers (RDF) *i.e.* T_4 after 150 days of application. T_4 also exhibited maximum leaf area per plant (1023.75 cm^2), early flower bud appearance (31.47 days), maximum number of flowering shoots per plant per month (3.8), number of flowers per plant per month (18.13) and flower yield per plant per hectare (5693.17 Kg) were also enhanced by T_4 whereas lowest values were noticed in T_9 (Arka microbial consortium + 50% RDF). Among all the treatments the available N (191.30 kg ha^{-1}), P (25.76 kg ha^{-1}), K (178.08 kg ha^{-1}) in soil, N (2.00%), P (0.40%), K (1.44%) content in plants and soil's bacterial population (2.373× 10^5 CFU) were enhanced by T_4.

Key words: Biostimulants and biofertilizer, bacterial population, nutrient status, rose.

INTRODUCTION

The rose (*Rosa hybrida* L.) includes attractive flowers with exquisite shapes, variations in sizes and forms, seductive colours and the most pleasant aroma, which made it a significant flower. It belongs to the family Rosaceae and has chromosome number 2n=14. After the green revolution, there has been a sharp rise in the usage of chemical pesticides and fertilisers in agriculture, endangering the environment and ecology. As a result, organic farming could be used as a substitute to maintain productivity while also protecting the environment. Plant biostimulants are materials that contain chemicals and microbes that, when applied to plants or the rhizosphere, accelerate natural processes. Biofertilizers are living microbes that improve soil nutrient availability or mobilize nutrients for plants. The use of biostimulants and biofertilizers in floriculture crop production enables better levels of sustainability by reducing fertilisers and environmental

contamination at the same time, boosts plant resistance to abiotic and biotic stresses and enhances internal and external quality. Hence, the present experiment was undertaken to study the effect of biostimulants and biofertilizer on bacterial population of soil, nutrient status of soil, plant growth and flowering of rose cv. Rose Sherbet.

MATERIALS AND METHODS

The present investigation was conducted during December 2021 to May 2022 at Model Floriculture Centre, G.B. Pant University of Agriculture & Technology, Pantnagar Udham Singh Nagar Uttarakhand.The experiment was laid out in a Randomized Block Design (RBD) with three replications and nine treatments *viz.*, 100 % Recommended dose of fertilizers (RDF) (T_1), RDF 75% + Fulvic acid (T_2), RDF 50% + Fulvic acid (T_3), RDF 75% + Humic acid (T_4), RDF 50% + Humic acid (T_5), RDF 75% + Sea weed extract (IFFCO Sagarika) (T_6), RDF 50% + Sea weed extract (IFFCO Sagarika) (T_7), RDF 75% + IIHR-Arka microbial consortium (T_8), RDF 50% + IIHR-Arka microbial consortium (T_9) under open condition. Fulvic acid, humic acid were applied @ 3g L^{-1} through foliar application at 15, 30 and 45 days after planting. Sea weed extract was applied @ 3 mL L^{-1} through foliar application at 15, 30 and 45 days after planting and arka microbial consortium was applied @ 50 g L^{-1} $plant^{-1}$ through soil drenching, 10 days after planting. For all the treatments, uniform cultural practices were followed during experimentation.The leaf samples were collected and subjected to nutrient analysis. Soil available nitrogen, phosphorus and potassium were estimated by alkaline $KMnO_4$ method (Subbiah and Asija 1956), Olsen's method (Olsen *et al.* 1954) and ammonium acetate method (Hanway and Heidel 1952) respectively. Plant nitrogen, phosphorus and potassium were determined by Micro Kjeldahl's method (Subbaiah and Asija 1956), Ammonium vanadomolybdo phosphoric acid yellow colour method (Jackson 1973) and flame photometer method (Jackson 1973) respectively. Total bacterial population was enumerated by standard plate count method (Messer *et al.* 1999).

RESULTS AND DISCUSSION

Based on analysis of variance (ANOVA), significant differences were recorded between treatments for all characteristics at 1% and 5% level of significance. The data depicted in Table 1 depicted that flowering parameters like plant height (63.53 cm), plant spread (55.57 cm) and leaf area per plant (1023.75 cm^2) were found highest in T_4 (75% RDF + Humic acid). This could be owing to the easier nutrient absorption, which would encourage protein synthesis from stored carbohydrates. These results are in conformity with El-Nashar (2021) in calendula, Praveen *et al.* in rose, Ali *et al.* (2014). For Flowering Parameters too, a significant difference was observed among all treatments. The maximum number of flowering shoots (3.80) and earliest days to harvest (44.40 days) was registered in T_4. The formation of early flower bud might have been impacted by triggering of such metabolic activity and lowering of the C:N ratio by the accumulation of carbohydrates. Early blooming would have also been influenced by the increased production of auxin and growth factors brought on by the application of humic acid. This may also be related to gibberellin-like activity of humic acid, according to Vaughan *et al.*, (1985). Similar results were reported by Bashir *et al.* (2016), Jabbar and AL-Bakkar (2022) in rose, Najarian *et al.* (2022) in *Pelargonium×hortorum and* Mirzaei *et al.* (2019).

Table 1: Effect of biostimulants and biofertilizer on plant growth and flowering of rose cv. Rose Sherbet.

Treatments	Plant height (cm)	Plant spread (cm)	Leaf area per plant (cm^2)	Days to flower bud appearance	No. of flowering shoots $plant^{-1}$	No. of flowers $plant^{-1}$ $month^{-1}$	Flower yield $plant^{-1}$ $month^{-1}$ (g)	Flower yield (Kg ha^{-1})
T_1	57.80	52.83	959.15	39.80	2.40	10.10	33.13	3680.64
T_2	61.27	54.23	996.50	35.07	3.27	14.07	45.99	5110.23
T_3	53.80	51.00	906.46	43.73	1.80	7.82	26.28	2920.29
T_4	63.53	55.57	1023.75	31.47	3.80	15.55	51.24	5693.17
T_5	57.13	52.23	921.52	41.80	2.07	8.75	28.69	3187.32
T_6	60.53	54.03	991.93	35.00	3.00	13.80	45.34	5037.45
T_7	54.93	51.43	914.13	44.00	1.80	7.75	25.30	2811.22
T_8	59.40	53.20	943.06	38.40	2.80	12.13	39.18	4352.84
T_9	52.60	50.57	895.90	43.80	1.73	6.15	20.28	2253.09
SEm ±	0.71	0.42	8.60	1.09	0.10	0.12	0.61	67.64
$CD_{0.05}$	2.15	2.55	25.80	3.29	0.31	0.36	1.83	202.80

The higher number of flowers per plant per month (15.55), greatest flower yield per plant per hectare (51.24 g) and flower yield per plant per month (5693.17 Kg) was noted in T_4. Increased photosynthetic activity brought by the application of humic acid may have contributed to an increase in dry matter accumulation and effective partitioning of photosynthates toward the sink, which could explain the increase in floral weight. The increased number of flowers per plant might be due to the presence of growth-promoting substances like essential plant nutrients, vitamins, enzymes and antibiotics. Improved translocation of more metabolites from source to sink may have resulted in increased yield. These results are in confirmation with the findings of Bashir *et al.* (2016) in gladiolus, Praveen *et al.* (2021) in rose, El-Nashar (2021) in calendula and Jabbar and

Table 2: Effect of biostimulants and biofertilizer on soil and plant properties of rose cv. Rose Sherbet

Treatments	Available nutrients (kg ha^{-1})			Plant nutrient content (%)			Total bacteria (CFU*)
	N	P	K	N	P	K	
T_1	175.11	22.54	170.61	1.34	0.31	1.34	1.817×10^5
T_2	186.07	24.18	175.16	1.40	0.36	1.40	2.320×10^5
T_3	165.74	19.00	161.79	1.31	0.26	1.31	1.853×10^5
T_4	191.30	25.76	178.08	1.44	0.40	1.44	2.373×10^5
T_5	170.43	21.90	167.79	1.32	0.29	1.32	1.957×10^5
T_6	184.23	24.48	174.51	1.39	0.34	1.39	2.293×10^5
T_7	164.74	20.40	166.51	1.33	0.27	1.33	1.897×10^5
T_8	181.05	23.08	171.36	1.37	0.30	1.37	2.277×10^5
T_9	162.65	18.07	164.27	1.29	0.24	1.29	1.870×10^5
SEm ±	1.62	0.43	0.91	0.01	0.01	0.01	3.04
$CD_{0.05}$	4.85	1.30	2.72	0.03	0.03	0.03	9.12
Initial nutrient status	157.63	15.09	158.67	1.04	0.24	1.04	1.583×10^5

*Colony forming units

AL-Bakkar (2022). The available nitrogen, phosphorus and potassium content in soil at peak flowering stage of rose differed significantly among the treatments (Table 2). The highest nitrogen content (191.30 kg ha^{-1}) was found in T_4 followed by T_2 which was at par with T_6. The maximum phosphorus content (25.76 kg ha^{-1}) was recorded in T_4 followed by T_6, T_2 and T_8 which were statistically at par with each other. The highest potassium content (178.08 kg ha^{-1}) was observed in T_4 followed by T_2 which was at par with T_6. These findings suggested that the addition of humic acid increased the nutrient content in the soil. Similar results were also reported by Li *et al.*, 2019 who advocated that humic acid increased total soil nitrogen, phosphorus, potassium, available nitrogen, phosphorus and potassium in peanut.

The plant nutrient estimation revealed significant differences among the treatments. The highest nitrogen, phosphorus and potassium content was observed in T_4 followed by T_2. However T_9 recorded minimum content. These results are in agreement with findings of Nikbakht *et al.* in gerbera and Noroozisharaf and Kavianiin thyme.

There was significant difference in the number of bacteria in all treatments and the bacterial count ranged from 2.373×10^5 in T_4 to 1.817×10^5 in T_1. Similar results were also found by Sellamuthu and Govindaswamy (2003) who reported that application of humic acid in sugarcane recorded higher bacterial population.

The study concluded that for getting better growth and flowering of rose cv. Rose Sherbet in open conditions, the plants must be sprayed with humic acid @ 3gL^{-1} at 15-day intervals, three times after planting and 75 per cent RDF (60:120:120 NPK kg ha^{-1}) which enhances the nutrient status of soil and plant, bacterial population in the soil also growth and flowering yield.

REFERENCES

Ali, A., Rehman, S.U., Raza, S. and Butt, S.J. 2014. Combined effect of humic acid and NPK on growth and flower development of *Tulipagesneriana* in Faisalabad, Pakistan. *J. Ornam. Plants,* **4:** 39-48.

Bashir, M., Qadri, R.W.K., Khan, I., Zain, M., Rasool, A. and Ashraf, U. 2016. Humic acid application improves the growth, floret and bulb indices of gladiolus (*Gladiolus grandiflorus* L.). Pak. *J. Science,* **68:** 121-127.

El-Nashar, Y.I. 2021. Effect of levels of humic acid at different times on improvement of the growth of calendula (*Calendula officinalis* L.) Plant. *Alex. Sci. Exch. J.,* **42:** 665-675.

Hanway J and Heidel H. 1952. Soil analysis. Methods as used in Iowa State College, *Soil Testing Laboratory Iowa Agriculture,* **57:** 43-45.

Jabbar, I.Y. and AL-Bakkar, A.H.A.Q. 2022. The effect of irrigation with magnetized water and spraying with humic acid on the production of cut flowers of the rose plant cv. Elida. *Eur. J. Dev. Res. Sustain.,* **3:** 93-97.

Jackson M.L. 1973. Soil chemical analysis, Prentice hall of India Pvt. Ltd., New Delhi, India, **498:** 151-154.

Li, Y., Fang, F., Wei, J., Wu, X., Cui, R., Li, G., Zheng, F. and Tan, D. 2019. Humic acid fertilizer improved soil properties and soil microbial diversity of continuous cropping peanut: a three-year experiment. *Scientific Reports,* **9**(1): 1-9.

Messer, J.W. Rice, E.W. and Johnson, C.H. 1999. Total viable counts-Pour Plate Technique. *Encyclopedia of Food Microbiology,* **3:** 2154-2158.

Mirzaei, N., Jabbarzadeh, Z. and Rasouli Sadaghiani, M.H. 2019. Investigation of some morphological and biochemical characteristics and vase life of Gerbera jamesonii cv. Dune cut flower using humic acid and nano calcium chelate. *Iran J. Hortic. Sci. Technol.* **20:** 157-170.

Najarian, A., Souri, M.K. and Nabigol, A. 2022. Influence of humic substance on vegetative growth, flowering and leaf mineral elements of Pelargonium x hortorum. *J. Plant Nutr.,* **45:** 107-112.

Nikbakht, A., Kafi, M., Babalar, M., Xia, Y.P., Luo, A. and Etemadi, N.A. 2008. Effect of humic acid on plant growth, nutrient uptake and postharvest life of gerbera. *Journal of Plant Nutrition,* **31**(12): 2155-2167.

Noroozisharaf, A. and Kaviani, M. 2018. Effect of soil application of humic acid on nutrients uptake, essential oil and chemical compositions of garden thyme (*Thymus vulgaris* L.) under greenhouse

conditions. *Physiology and Molecular Biology of Plants,* **24**(3): 423-431.

Olsen, S.R. Cole. C.V., Wetanabe, F.S. and Dean, L.A. 1954. Estimation of available phosphorus by extraction with sodium bicarbonate. *USDA Circular,* **939**(8): 1-19.

Praveen, T.M., Patil, S.R., Patil, B.C., Seetharamu, G.K., Rudresh, D.L., Pavankumar, P. and Patil, R.T. 2021. Influence of biostimulants on growth and yield of floribunda rose cv. Mirabel. *J. Pharmacogn. Phytochem,* **10:** 2701-2705.

Sellamuthu, K.M. and Govindaswamy, M. 2003. Effect of fertiliser and humic acid on rhizosphere microorganisms and soil enzymes at an early stage of sugarcane growth. *Sugar Tech.,* **5**(4): 273-277.

Subbiah, B.D. and Asija, G.L. 1956. A rapid procedure for the estimation of available nitrogen in soils. *Current Science,* **25:** 259-260.

Vaughan, D., Malcolm, R.E. and Ord, B.G. 1985. Influence of humic substances on biochemical processes in plants. In: 'Vaughan, D., Malcolm, R.E. (Eds.) *Soil Organic Matter and Biological Activity'.* 16. Springer Nature, Switzerland. pp. 77-108.

(Received: March 2025 and Accepted: May 2025)