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Influence of Fertigation, Microbial Consortium and Bio-Stimulants on Quality Parameters and Yield of Edward Rose

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Abstract

An experiment was conducted to evaluate the effect of fertigation, microbial consortium and bio-stimulants on the quality parameters consisting of anthocyanin content, soluble proteins and starch content of Edward Rose at Coimbatore during 2015 to 2020. It consisted of various kinds of treatments at three levels of the recommended dose of fertilizer through fertigation (RDFTF) gradients (125,100 and 75 per cent NPK), (RDF @ 178: 178: 356 kg NPK ha^{-1}), recommended dose of Microbial Consortium from IIHR, Bangalore which contains Azospirillum and Phosphobacteria (MC) @ 12.5 kg ha^{-1}, foliar spray of Panchagavya (3 and 4 %) and also humic acid (0.4 and 0.5%) were laid out in Randomized Block Design with two replications. The results revealed that high anthocyanin content of 0.915(A525 value) were recorded in the treatment (T_{12}) which received the application of 100 percentage of RDFTF along with MC @ 12.5 kg ha^{-1} with 4 per cent Panchagavya and 0.5 per cent Ureic acid followed by the treatment (T_{10}) with the application of 100 percentage of RDFTF along with MC @ 12.5 kg ha^{-1}, 3 per cent Panchagavya and 0.4 per cent Ureic acid (0.895 A525 value), high values of soluble proteins in petals (8.81 mg gm^{-1}), the maximum values of soluble protein in leaves (38.71 mg gm^{-1}) and the highest starch content of 89.84 mg gm^{-1} were recorded besides the overall of yield of flowers in number of 3836302 and 9302 kg of flower ha^{-1}. From the overall findings, it can be concluded that the treatment combinations with 100 per cent of RDFTF along with MC @ 12.5 kg ha^{-1} and 4 per cent Panchagavya and 0.5 per cent humic acid recorded maximum quality related parameters besides other growth and yield parameters.

Key words: Edward rose, Fertigation, Microbial consortia, Panchagavya, Humic acid, Anthocyanin, Soluble protein, Starch, Quality parameters

Flowers are being recognized as a symbol of beauty, love and tranquility. They form the main soul of a garden and they convey the message of nature to our mankind. Flowers are the greatest gifts of nature which are forming an integral part of human life and also in satisfying the basic human aesthetic desire. Their vibrant colors, delicate forms, and enchanting fragrances symbolize beauty, love, and serenity. In gardens, they serve as nature's artwork, creating spaces of peace and inspiration. Roses (*Rosa ssp*.) are one of the most important commercial crops which are grown for a variety of purposes such as pot plant, garden plant and also as a cut flower production. Subramanian [1] reveals that Horticulture is becoming increasingly important, especially during and after the pandemic world, for a variety of reasons. Horticulture has long been recognized as a specialized arm of agriculture to produce nutrient rich and economy boosting commodities such as fruits, flowers and vegetables [2]. In addition to this, the art of gardening including innovative designing with plants, maintaining gardens and landscapes are also considered as an important part of Horticulture. Historically speaking, Cyrus the great of ancient Persia is credited to be the first person to give importance of this 'art' of growing garden plants, around 500 BC. Now horticulture has evolved into an important science, practice and a livelihood that commands several hundred billion dollars worldwide.

One of the most popular loose flower crops of domestic and international markets is Edward Rose. It is very much appreciated for its colour, fragrance, form, size and value-added products [3]. Cut flowers always have the inherent properties and methods to increase its shelf life and vase life by many pulsing techniques and chemicals added to the vase solutions where as many of the loose flowers especially the Edward roses are having poor shelf life when compared the Andhra Red rose type flowers. Edward roses are the popular choice of the plant for many farmers and it can be grown easily in all the climatic zones especially in the open field conditions. The main advantage of its cultivation is that the initial costs and other maintenance costs are very low and it is very easy and comfortable for all the farmers to undertake its cultivation [4]. Mostly these flowers can be used as loose flowers and they need to be utilized on the same day of the harvest or on the next day itself. "Say it with a flower" is an important phrase which is widely used by the common people during any kind of functions or during a memorable occasion. It reinforces the importance of flowers by its significance as well as the relevance to the function. On the other hand, loose flowers, which are typically

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smaller and not sold with stems for arrangement in vases, often have a shorter shelf life. Among these, varieties like Edward roses tend to have poorer shelf life compared to other rose types, such as the Andhra Red rose, which is known for its better durability and longer freshness [5]. The reduced shelf life of Edward roses could be attributed to factors like higher sensitivity to dehydration, ethylene production, or susceptibility to microbial growth. These flowers may not benefit as much from the same pulsing techniques or vase solutions due to their specific physiological and biochemical characteristics [6]. Consequently, they require targeted post-harvest treatments to improve their marketability and usability.

MATERIALS AND METHODS

The present experiment was conducted to evaluate the effect of fertigation, microbial consortium and bio stimulants on various quality parameters of Edward Rose at Coimbatore during 2015 to 2020. The quality parameters observed were anthocyanin content, soluble protein in leaves, soluble protein in petals and starch content in petals. The treatment consisted of three levels of the recommended dose of fertilizer through fertigation (RDFTF) gradients (125,100 and 75 per cent NPK), recommended dose of Microbial Consortium which contains Azospirillum and Phosphobacteria (MC) (12.5 kg ha^{-1}), foliar spray of Panchagavya (3 and 4%) and humic acid (0.4 and 0.5%) were laid out in Randomized Block Design with two replications. All the data were collected and statistically analyzed and interpreted. The geographical details of the experimental location was with a Latitude of 110 02" N, Longitude of 76057" East and Altitude of 1348 feet (411 meters above MSL) and with the prevailing weather details of Maximum temperature of 35°C (95°F), Minimum temperature of 18°C (64 °F), Mean annual rainfall of 790 millimeters and average Relative Humidity of 68 per cent. Biometrical observations were measured in each treatment and replication wise and averaged. The data collected were tabulated systematically and subjected to statistical analysis as suggested by Panse and Sukhatme [7]. The critical difference was worked out at five per cent ($p < 0.05$) probability level.

Treatment No.	Treatment details
T_1:	125% Recommended dose of fertilizers through fertigation (RDFTF)
T_2:	125% RDFTF + Microbial consortium (MC) @ 12.5 kg ha^{-1}
T_3:	125% RDFTF + MC @ 12.5 kg ha^{-1} + 3% Panchagavya + 0.4% Humic Acid
T_4:	125% RDFTF + MC @ 12.5 kg ha^{-1} + 3% Panchagavya + 0.5% Humic Acid
T_5:	125% RDFTF + MC @ 12.5 kg ha^{-1} + 4% Panchagavya + 0.4% Humic Acid
T_6:	125% RDFTF + MC @ 12.5 kg ha^{-1} + 4% Panchagavya + 0.5% Humic Acid
T_7:	100% RDFTF
T_8:	100% RDFTF + MC @ 12.5 kg ha^{-1}
T_8:	100% RDFTF + MC @ 12.5 kg ha^{-1} + 3% Panchagavya + 0.4% Humic Acid
T_{10}:	100% RDFTF + MC @ 12.5 kg ha^{-1} + 3% Panchagavya + 0.5% Humic Acid
T_{11}:	100% RDFTF + MC @ 12.5 kg ha^{-1} + 4% Panchagavya + 0.4% Humic Acid
T_{12}:	100% RDFTF + MC @ 12.5 kg ha^{-1} + 4% Panchagavya + 0.5% Humic Acid
T_{13}:	75% RDFTF
T_{14}:	75% RDFTF + MC @ 12.5 kg ha^{-1}
T_{15}:	75% RDFTF + MC @ 12.5 kg ha^{-1} + 3% Panchagavya + 0.4% Humic Acid
T_{16}:	75% RDFTF + MC @ 12.5 kg ha^{-1} + 3% Panchagavya + 0.5% Humic Acid
T_{17}:	75% RDFTF + MC @ 12.5 kg ha^{-1} + 4% Panchagavya + 0.4% Humic Acid
T_{18}:	75% RDFTF + MC @ 12.5 kg ha^{-1} + 4% Panchagavya + 0.5% Humic Acid
T_{19}:	100% RDF as Soil application – Control

RDF (Recommended dose of fertilizers): NPK 178:178:356 kg ha^{-1}

RESULTS AND DISCUSSION

Quality parameters include the composition of Anthocyanin, soluble protein in leaves, soluble protein in petals and starch content. They are having direct influence on the floral parameters and result in higher yield and other yield attributes. In the present experiment, high anthocyanin content of 0.915(A525 value) were recorded in the treatment (T_{12}) which received the application of 100 percentage of RDFTF along with MC @ 12.5 kg ha^{-1} with 4 per cent Panchagavya and 0.5 per cent Ureic acid followed by the treatment (T_{10}) with the application of 100 percentage of RDFTF along with MC @ 12.5 kg ha^{-1}, 3 per cent Panchagavya and 0.4 per cent Ureic acid (0.895 A525 value) when compared to the control (T_{19}) with the soil application of 100 per cent of RDF fertilizers (0.420 A525 value). More soluble proteins in petals of 8.81 mg gm^{-1} was recorded in the treatment (T_{12}) which received the application of 100 percentage of RDFTF along with MC @ 12.5 kg ha^{-1} with 4 per cent Panchagavya and 0.5 per cent Ureic acid followed by the treatment (T_{10}) (8.71 mg gm^{-1}). Maximum soluble protein in leaves of 38.71 mg gm^{-1} was recorded in the treatment T_{12} (32.56 mg gm^{-1}) (Table 1). High starch content of 89.84 mg gm^{-1} were recorded in the treatment (T_{12}) followed by the treatment T_{10} (88.93 mg gm^{-1}) when compared to the control (T_{19}) with the soil application of 100 per cent of RDF fertilizers (83.11 mg gm^{-1}) (Table 1, Fig 1). The evaluation of quality parameters, including anthocyanin composition, soluble protein content in leaves and petals, and starch content, plays a critical role in influencing floral attributes and yield performance. These biochemical constituents are directly correlated with the overall health, aesthetic appeal, and productivity of flowering plants. The present experiment investigates the effects of various treatments involving fertigation, microbial consortium (MC), and bio-stimulants on these parameters. Integrating bio-stimulants like Panchagavya and Ureic acid with microbial consortium and fertigation practices enhances anthocyanin content, soluble protein levels, and starch reserves. These improvements directly translate into superior floral attributes and higher yield potential, making these treatments highly beneficial for sustainable floriculture practices.

Flowers are rich source of bio-pigments and have potential usage as food colours. The total monomeric Anthocyanin content of Hibiscus flowers yielded highest amount when extracted with methanol (160.31 mg liter^{1}) [8].

Similar findings were also reported by Dahab *et al*. [9] in chrysanthemum, Goyal and Gupta [10]; Arun [11] and Ramalingam [12] in rose. The soluble protein content is an indicator of carboxylation process. It was higher in the period of active growth of plants. The soluble protein content found in leaves indirectly indicates the photosynthetic efficiency of the crop since it constitutes more than 70 per cent of the RuBP carboxylase which is the enzyme responsible for CO_2 fixation in photosynthesis in *Gloriosa superba* [13]. Both of them helped in more photosynthetic activity and in turn helped in enhanced growth of rose plants and yield of flowers. Similar trend was observed in the overall of yield of flowers in number of 3836302 and 9302 kg of flower ha^{-1} (Table 2-3), Fig 2-4). Similar trends were observed in Rose by Haripriya *et al*. [14], in banana by Senthilkumar *et al*. [15].

Table 1 Effect of fertigation, microbial consortium and bio - stimulants on anthocyanin, soluble protein and starch content

Anthocyanin, soluble protein and starch content

Treatment	Anthocyanin (A525)	Soluble protein in petals (mg g^{-1})	Soluble protein in leaf (mg g^{-1})	Starch (mg g^{-1})
T_1	0.455	8.395	23.150	85.975
T_2	0.530	8.485	24.130	88.730
T_3	0.565	8.545	29.695	88.895
T_4	0.615	8.665	28.760	88.465
T_5	0.680	8.630	33.435	88.605
T_6	0.645	8.520	33.050	88.790
T_7	0.695	8.430	33.585	88.695
T_8	0.715	8.580	35.370	89.210
T_9	0.760	8.575	33.145	88.880
T_{10}	0.895	8.705	32.560	88.925
T_{11}	0.815	8.525	31.365	88.710
T_{12}	0.915	8.810	28.710	89.840
T_{13}	0.855	8.505	39.200	88.705
T_{14}	0.840	8.495	33.585	88.660
T_{15}	0.850	8.410	33.540	88.725
T_{16}	0.805	8.365	35.510	87.740
T_{17}	0.870	8.375	34.090	87.970
T_{18}	0.770	8.465	37.275	87.955
T_{19}	0.420	8.250	21.795	83.110
Mean	0.721	8.512	31.682	88.241
SE(m)	0.048	0.055	1.813	0.741
SE(d)	0.068	0.078	2.564	1.049
CD (p= 0.05)	0.144	0.166	5.428	2.22

Table 2 Effect of fertigation, consortium of biological sources and bio inoculants on number of flowers $year^{-1}$ $hectare^{-1}$

Yield of number of flowers $year^{-1}$ $hectare^{-1}$

Treatment	Phase 1	Phase 2	Phase 3	Phase 4	Total	Overall average
T_1	589323	733802	904896	733802	2961823	740456
T_2	627344	768021	912500	768021	3075885	768971
T_3	769922	851667	1011354	817448	3450391	862598
T_4	788932	866875	1064583	851667	3572057	893014
T_5	779427	855469	1018958	825052	3478906	869727
T_6	806042	885885	1072188	855469	3619583	904896
T_7	608333	752813	893490	752813	3007448	751862
T_8	627344	779427	927708	775625	3110104	777526
T_9	807943	897292	1083594	866875	3655703	913926
T_{10}	836458	912500	1087396	912500	3748854	937214
T_{11}	826953	904896	1079792	893490	3705130	926283
T_{12}	851667	950521	1102604	931510	3836302	959076
T_{13}	570313	710990	870677	714792	2866771	716693
T_{14}	617839	760417	897292	760417	3035964	758991
T_{15}	665365	794635	942917	794635	3197552	799388
T_{16}	722396	821250	980938	809844	3334427	833607
T_{17}	703385	809844	950521	798438	3262188	815547
T_{18}	741406	844063	1007552	813646	3406667	851667
T_{19}	570313	730000	897292	730000	2927604	731901
Mean	711090	822651	984539	810844	3329124	832281
SE(m)	24,552	11,212	21,337	15,508	72,608	59,687
SE(d)	34,722	15,856	30,175	21,931	102,684	84,411
CD (p= 0.05)	73,514	33,569	63,886	46,433	217,402	178,714

Table 3 Effect of fertigation, consortium of biological sources and bio inoculants on yield of flower hectare-1 (kg)

Treatment	Yield of flower hectare-1 (kg)					
	Phase 1	Phase 2	Phase 3	Phase 4	Average phase-1	Total yield ha-1
T_1	1340.23	1669.11	2057.69	1669.11	1684.04	6736.15
T_2	1431.10	1751.39	2080.50	1750.78	1753.44	7013.78
T_3	1732.42	1916.10	2275.32	1839.45	1940.82	7763.28
T_4	1786.98	1963.43	2411.28	1928.95	2022.66	8090.64
T_5	1698.01	1866.06	2223.15	1797.02	1896.06	7584.24
T_6	1752.65	1926.06	2332.50	1861.88	1968.27	7873.09
T_7	1362.67	1686.60	2000.66	1686.60	1684.13	6736.53
T_8	1426.54	1772.53	2111.07	1765.08	1768.81	7075.22
T_9	1833.93	2036.70	2459.57	1968.11	2074.58	8298.31
T_{10}	1963.21	2144.38	2558.35	2144.38	2202.58	8810.30
T_{11}	1832.70	2003.55	2390.14	1977.08	2050.87	8203.47
T_{12}	2065.67	2305.01	2672.86	2258.44	2325.50	9301.99
T_{13}	1256.59	1567.83	1919.94	1576.31	1580.16	6320.66
T_{14}	1402.87	1726.15	2036.85	1726.15	1723.00	6892.02
T_{15}	1490.04	1780.06	2112.29	1779.91	1790.57	7162.29
T_{16}	1614.36	1832.76	2186.81	1804.93	1859.71	7438.85
T_{17}	1580.15	1817.47	2131.83	1792.91	1830.59	7322.36
T_{18}	1607.14	1827.13	2180.68	1761.81	1844.19	7376.76
T_{19}	1269.90	1624.63	1996.09	1624.63	1628.81	6515.25
Mean	1602.48	1853.52	2217.77	1827.03	1875.20	7500.80
SE(m)	72.37	51.29	69.42	53.46	61.63	246.53
SE(d)	102.34	72.53	98.17	75.60	87.16	348.64
CD (p= 0.05)	216.68	153.56	207.85	160.05	184.53	738.14

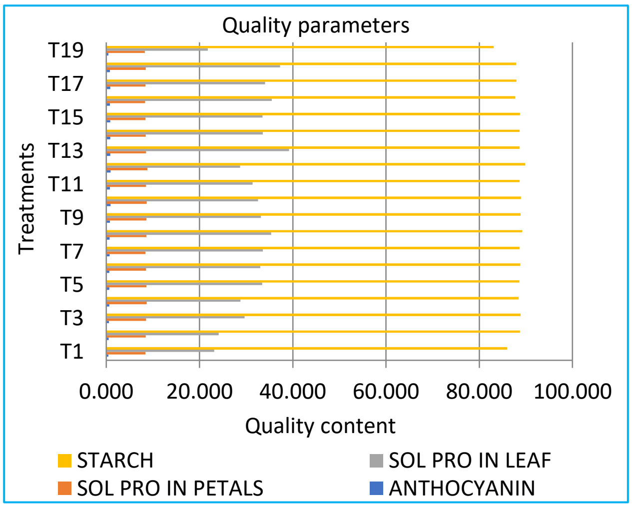

Fig 1 Effect of fertigation, microbial consortium and bio-inoculants on quality parameters

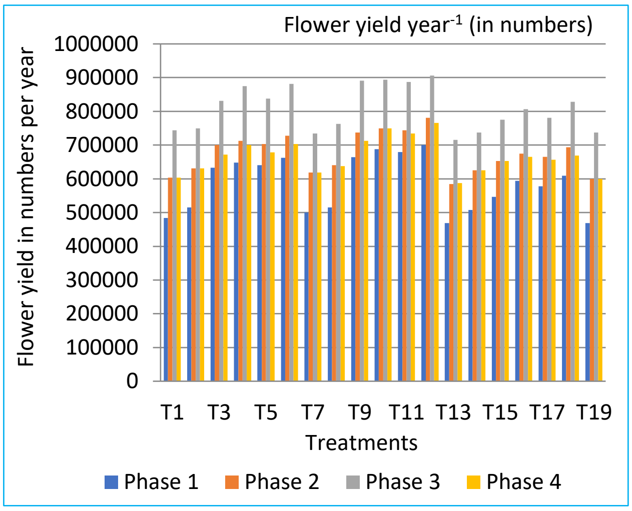

Fig 2 Effect of fertigation, microbial consortium and bio-inoculants on flower yield year-1 (in numbers)

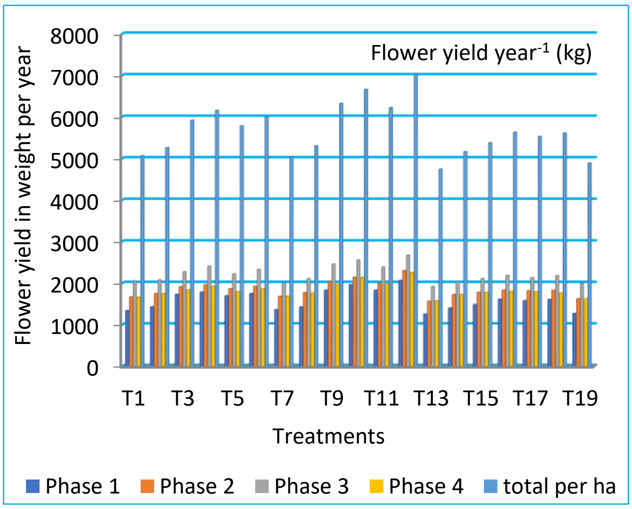

Fig 3 Effect of fertigation, microbial consortium and bio-inoculants on flower yield year-1 (kg)

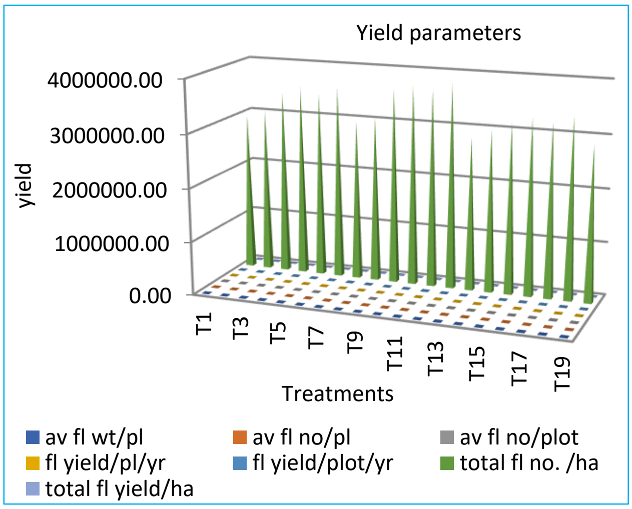

Fig 4 Effect of fertigation, microbial consortium and bio-inoculants on yield parameters

CONCLUSION

From the overall findings, it could be inferred that the treatment combinations with 100 per cent of RDFTF along with MC @ 12.5 kg ha^{-1} and 4 per cent Panchagavya and 0.5 per cent Humic acid (T_{12}) was found to be the most significant one for ensuring all the desirable quality related parameters besides growth and other yield attributes of Edward Rose. Thus, the quality parameters viz., Anthocyanin, soluble protein in leaves, soluble protein in petals and starch content are having direct influence on the floral parameters and they result in higher yield and other yield related attributes.

LITERATURE CITED

1. Subramaniyan J. 2021. Role of horticulture in the next generation: Planet earth and beyond. *International Horticulture Conference on NextGen-Hort 2021* – Compendium of Lead and Research Papers. pp 1-8.
2. Ferreira CSS, Soares PR, Guilherme R, Vitali G, Boulet A, Harrison MT, Malamiri H, Duarte AC, Kalantari Z, Ferreira AJD. 2024. Sustainable water management in horticulture: Problems, premises, and promises. *Horticulturae* 10(9): 951.
3. Noh YM, Hida AA, Raymond O, Comte G, Bendahmane M. 2023. The scent of roses, a bouquet of fragrance diversity. *Journal of Experimental Botany* 75(5): 1-13.
4. Sharma P, Thakur N. 2020. Effect of pulsing and storage methods for extending vase life of cut flowers. *International Journal of Chemical Studies* 8(6): 1320-1328.
5. Sharma S, Awasthi L, Kumari P. 2023. Evaluating the phytochemical composition and antioxidant activity of leaves of different rose varieties. *International Journal of Plant Biology* 14(4): 1051-1063.
6. In BC, Lim JH 2018. Potential vase life of cut roses: Seasonal variation and relationships with growth conditions, phenotypes, and gene expressions. *Postharvest Biology and Technology* 135: 93-103.
7. Panse VG, Sukhatme PV. 1985. *Statistical Methods for Agricultural Workers*. 2nd Edition, ICAR, New Delhi.
8. Thamaraiselvi SP, Uma D, Jiji Allen, Lavanya V. 2021. Extraction of bio-pigments from ornamental flowers. *International Horticulture Conference on NextGen-Hort 2021* - Compendium of Lead and Research Papers. pp 187-192.
9. Dahab AM, El-Dahab RS, Salem MA. 1987. Effect of gibberellic acid on growth, flowering and constituents of chrysanthemum. *Acta Hort*. 205: 129-135.
10. Goyal RK, Gupta AK. 1994. Effect of growth regulators on nutritional status, anthocyanin content and vase life of rose cv. Super star. *Haryana Jr. Hort. Science* 23(2): 118-121.
11. Arun. 1999. Chemical regulation of growth and flowering in rose under greenhouse conditions. *M. Sc. (Hort.) Thesis*, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu.
12. Ramalingam K. 2008. Effect of growth regulating substances on growth, yield and post-harvest quality of cut rose cv. Happy Hour. *M. Sc. (Hort.) Thesis*, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu.
13. Balakumbahan R. 2008. Studies on standardization of pre- and post-harvest treatments in *Gloriosa superba* L. *Ph. D (Hort.) Thesis*, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu.
14. Haripriya K, Senthilkumar S, Sriramachandrasekharan V. 2004. Effect of vermicompost and fertilizer on the growth and yield of rose. *Jr. Interacad*. 8(2): 207-210.
15. Senthilkumar M, Ganesh S, Srinivas K, Pannerselvam P. 2014. Influence of fertigation and consortium of biofertilizers on photosynthesis, chlorophyll content, yield parameters and yield of banana cv. Robusta (AAA). *Plant Archives* 14(1): 387-391.