Full Length Research Article

CARAS

Research Journal of Agricultural Sciences
Volume 16; Issue 01 (Jan–Feb 2025); pp 101–105

ISSN: 0976-1675 (P)
ISSN: 2249-4538 (E)

Impact of Fertigation, Microbial Consortium and Bio-stimulants on Physiological Properties and Vase life of Edward Rose

S. Ramkumar*[1] and S. Ganesh[2]

[1-2] School of Agriculture and Animal Sciences, Gandhigram Rural Institute (Deemed to be University), Gandhigram - 624 302, Dindigul, Tamil Nadu, India

Received: 18 Dec 2024; Revised accepted: 10 Feb 2025

Abstract

An experiment was conducted to evaluate the effect of fertigation, microbial consortium and bio - stimulants on the physiological parameters and vase life of Edward Rose at Coimbatore during 2015 to 2020. The treatments which consisted of 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 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 (RBD) with two replications. The results revealed that higher impact in the petal retention with 24.50, 35.50, 37.00 and 42.50 hours respectively under the situations of flowers left in plant itself, harvested flowers kept in the room temperature, flowers kept in water and flowers kept under refrigeration 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 Humic 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 Humic acid (24.50, 30.00, 32.00 and 38.50 hours respectively) when compared to the control (T_{19}) with the soil application of 100 per cent of RDF fertilizers (23.00, 20.50, 19.50 and 27.00 hours respectively). 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 the most desirable physiological properties, vase life besides other growth and yield parameters.

***Key words*:** Edward rose, Fertigation, Microbial consortia, Panchagavya, Humic acid, Bio-stimulants, Physiological properties, Vase life

Edward Rose flower is considered to be one of the most popular loose flower crops of domestic and international markets. It is very much appreciated for its colour, fragrance, form, size and value-added products. 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 [1-2]. 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 [3]. “Say it with a flower” is an important phrase which reinforces the importance of flowers by its significance as well as the relevance to the function. 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. The vase life or the shelf life of the rose flowers is the major concern in the garland making and its longevity [4]. Based on its duration, it can fetch higher returns for the farmers.

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 physiological parameters observed were moisture content of flower petals, weight loss percentage, relative water content, dry matter production and petal retention duration (vase life). 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 were with a Latitude of 110 02" N, Longitude of 76057" East and Altitude of 1348 feet (411 meters above MSL) and with the 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

***Correspondence to:** S. Ramkumar, E-mail: ramkumarhorti@gmail.com; Tel: +91 9842812540

Citation: Ramkumar S, Ganesh S. 2025. Impact of fertigation, microbial consortium and bio-stimulants on physiological properties and vase life of Edward Rose. *Res. Jr. Agril. Sci.* 16(1): 101-105.

relative humidity of 68 per cent. Biometrical observations were measured in each treatment and replication wise and averaged. The data were tabulated systematically and subjected to statistical analysis as suggested by Panse and Sukhatme [5]. The critical difference was worked out at five per cent ($p < 0.05$) probability level. Treatment details are as under:

Treatment No.	Treatment details
T_1	125% Recommended dose of fertilizers through fertigation (Recommended Dose of Fertilizer through Fertigation)
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_9	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

Remarkable changes in the moisture content were noticed in Edward rose plants in this present investigation. Maximum value of 82.67, 78.41 and 56.81 per cent respectively under the situation of the first day after harvest, second day of flower kept in water and second day of flower kept in room temperature 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 Humic acid. (Table 1, Fig 1).

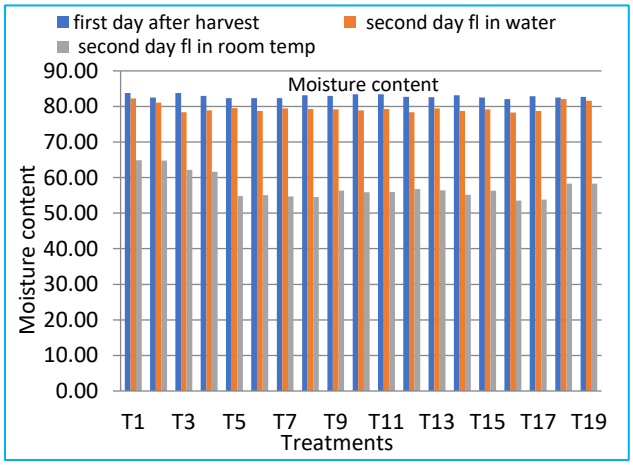

Fig 1 Impact of fertigation, microbial consortium and bio-inoculants on moisture content

Table 1 Impact of fertigation, microbial consortium and bio-stimulants on moisture content

Treatment No.	Moisture content		
	First day after harvest	Second day flowering in water	Second day flowering in room temp
T_1	83.74	82.22	64.92
T_2	82.52	81.09	64.75
T_3	83.78	78.34	62.21
T_4	83.01	78.95	61.67
T_5	82.35	79.59	54.79
T_6	82.37	78.74	55.04
T_7	82.38	79.46	54.72
T_8	83.14	79.24	54.57
T_9	83.00	79.20	56.35
T_{10}	83.39	78.91	55.90
T_{11}	83.45	79.26	55.93
T_{12}	82.67	78.41	56.81
T_{13}	82.62	79.48	56.43
T_{14}	83.16	78.74	55.16
T_{15}	82.52	79.21	56.31
T_{16}	82.03	78.30	53.53
T_{17}	82.89	78.73	53.82
T_{18}	82.51	82.07	58.35
T_{19}	82.69	81.63	58.30
Mean	82.85	79.55	57.34
SE(m)	0.337	0.553	2.918
SE(d)	0.476	0.783	4.127
CD (p= 0.05)	NS	1.657	NS

The results revealed that flower senescence process flowers are generally related to a decrease in water content, depletion in nutrients reserves, an increase in ethylene production and a reduction in water absorption. The early water stress created in the stalk might have caused disturbance in the transport of water and plugging of conducting tissue either physically or by microorganisms entering through the vase water in Carnation [6]. In this study, critical changes in the weight loss of 29.86, 61.46 and 10.35 per cent respectively under the conditions of flowers kept in water, kept in ambient air and flowers kept in refrigeration 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 Humic acid (Table 2, Fig 2). Moisture content of rose flowers under the study remained the same on the day of flower opening. However, on the second day of flower opening, when severed from the plant and kept under

ambient air, it was found that the moisture content declined rapidly. The reduction in moisture content when held in ambient air could be due to the rapid water loss of the petals under open conditions. The depletion of moisture remained lower when held in water. This could be related to the fact that there is an increased loss of petal turgidity and greater water loss of petals. A similar declining trend of water loss has been reported in cut *Rosa hybrida* by Carpenter and Rasmussen [7], Paull and Goo [8], Paull *et al*. [9] also made similar observations in Anthurium flowers of the cv. Ozaki Red after harvest.

Table 2 Impact of fertigation, microbial consortium and bio-stimulants on weight loss (Per cent)

Weight loss (per cent)			
Treatment No.	Flowering in water	Flowering in ambient air	Flowering in refrigeration
T_1	22.69	58.83	7.15
T_2	23.90	56.33	7.21
T_3	25.57	55.64	9.44
T_4	25.45	56.54	9.17
T_5	30.55	57.11	10.26
T_6	31.00	63.25	10.40
T_7	30.75	62.49	10.39
T_8	30.32	62.14	10.36
T_9	30.64	62.83	10.41
T_{10}	29.68	62.59	10.73
T_{11}	30.30	61.99	10.44
T_{12}	29.86	61.46	10.35
T_{13}	30.30	61.29	10.55
T_{14}	30.67	61.91	11.15
T_{15}	31.14	60.97	11.51
T_{16}	30.64	61.80	11.19
T_{17}	31.04	58.61	10.92
T_{18}	28.33	59.40	8.16
T_{19}	28.48	59.37	8.35
Mean	29.01	60.24	9.90
SE(m)	2.116	3.516	1.022
SE(d)	2.993	4.973	1.445
CD (p= 0.05)	NS	NS	NS

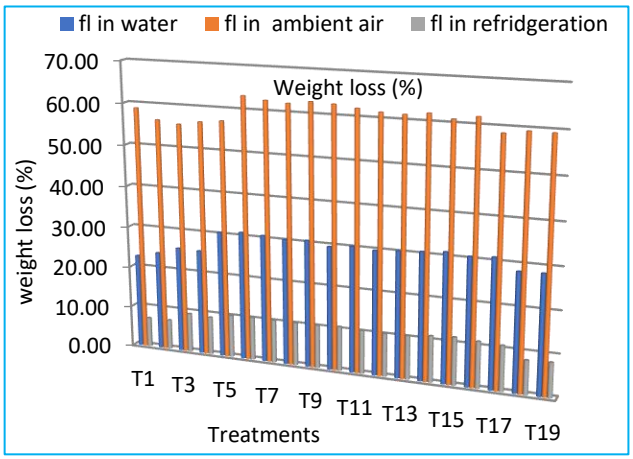

Fig 2 Impact of fertigation, microbial consortium and bio-inoculants on weight loss of flowers

A rapid decline in moisture content of flowers of *Rosa hybrida* 'Samantha', four days after vase holding was identified as the main cause of flower senescence by Xue and Lin [10]. This statement is in agreement with the present research. The maintenance of higher levels of moisture contents in flowers held in water may be due to the reduced water loss from the tissue of flowers. Weight loss of flowers also showed a similar trend in ambient air. Similar encounters have been made in carnation [11-12], *Hibiscus rosa sinensis* cv. Pink Versicolor [13-14] and Digitalis during senescence. These reports lend support to the present work. Changes in fresh weight of flowers, which reflected a senescing symptom such as wilting, have also been reported by Nichols [15-16] in carnation and by Sharma [17] in *Rosa damascena*. The relative water content of 74.07, 57.89 and 66.63 per cent respectively under the conditions of flowers kept in ambient room temperature, flowers kept in water and flowers kept in refrigeration 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 Humic acid (Table 3, Fig 3).

Table 3 Impact of fertigation, microbial consortium and bio-stimulants on relative water content (RWC)

Relative water content (RWC)			
Treatment No.	Flowering in ambient room temp	Flowering in water	Flowering in refrigeration
T_1	76.12	59.53	70.04
T_2	78.04	59.90	69.96
T_3	75.13	59.89	69.85
T_4	74.98	60.06	66.07
T_5	74.51	60.26	66.43
T_6	73.23	57.21	66.44
T_7	74.78	58.10	66.62
T_8	74.59	57.71	66.24
T_9	74.92	57.08	66.42
T_{10}	75.21	57.70	66.76
T_{11}	74.23	57.13	66.65
T_{12}	74.07	57.89	66.63
T_{13}	74.22	58.06	66.56
T_{14}	74.62	57.53	66.76
T_{15}	75.44	57.68	66.48
T_{16}	74.70	57.29	68.37
T_{17}	74.30	62.73	67.91
T_{18}	74.74	62.97	68.21
T_{19}	75.84	60.23	68.21
Mean	74.93	58.89	67.40
SE(m)	0.688	3.579	0.785
SE(d)	0.973	5.061	1.111
CD (p= 0.05)	NS	NS	2.352

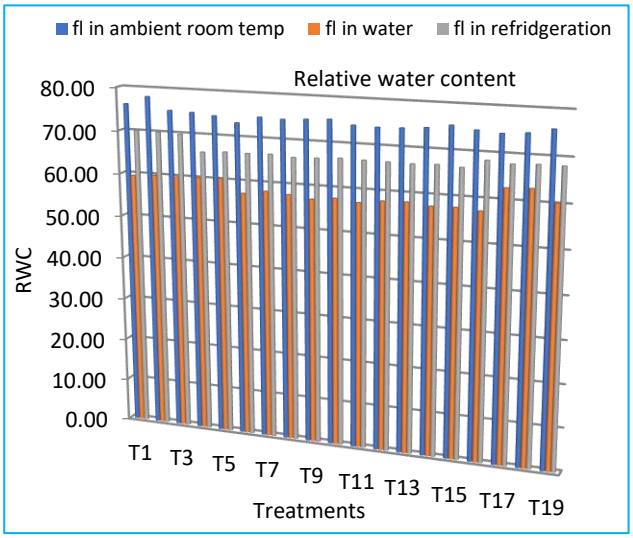

Fig 3 Impact of fertigation, consortium of bio fertilizers and bio inoculants on relative water content

In this research, high dry matter production of 82.50, 43.00 and 67.00 respectively for the shoot, root and leaf 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 Humic acid (Table 4, Fig 4). Hence the physiological parameters were found to be significantly higher in the treatment (T_{12}) which received the application of 100 percentage of recommended dose of fertilizer through fertigation (RDFTF) along with MC @ 12.5 kg ha^{-1} with 4 per cent Panchagavya and 0.5 per cent humic acid.

Table 4 Impact of fertigation, microbial consortium and bio-stimulants on dry matter production

	Dry matter production (DMP)				
Treatment No.	Shoot	Root	Leaf	Shoot leaf^{-1}	Leaf stem^{-1}
T_1	35.00	21.00	26.50	1.67	0.76
T_2	57.50	33.00	46.00	1.75	0.80
T_3	55.50	30.00	42.00	1.85	0.76
T_4	48.00	26.50	38.00	1.81	0.79
T_5	41.00	23.00	32.00	1.78	0.78
T_6	53.00	28.50	40.50	1.86	0.76
T_7	51.50	27.50	39.50	1.87	0.77
T_8	49.50	27.50	38.50	1.80	0.78
T_9	47.00	26.00	36.00	1.81	0.77
T_{10}	57.00	35.00	44.00	1.63	0.77
T_{11}	66.50	37.50	51.50	1.77	0.77
T_{12}	82.50	43.00	67.00	1.92	0.81
T_{13}	52.50	29.00	41.00	1.81	0.78
T_{14}	50.50	32.50	38.00	1.55	0.75
T_{15}	48.00	27.00	37.00	1.78	0.77
T_{16}	50.00	28.50	38.50	1.75	0.77
T_{17}	47.00	27.50	35.50	1.71	0.76
T_{18}	53.00	27.50	41.50	1.94	0.78
T_{19}	33.00	20.50	24.00	1.61	0.73
Mean	51.47	29.00	39.84	1.77	0.77
SE(m)	1.148	0.676	0.77	0.059	0.014
SE(d)	1.624	0.957	1.09	0.083	0.02
CD (p= 0.05)	3.438	2.025	2.307	0.177	N/A

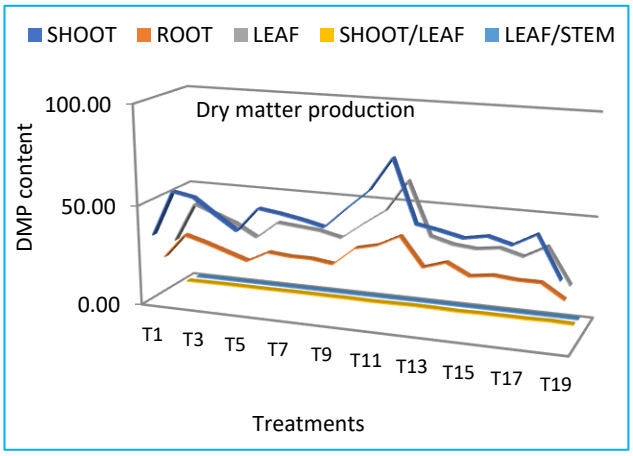

Fig 4 Impact of fertigation, microbial consortium and bio-inoculants on dry matter production

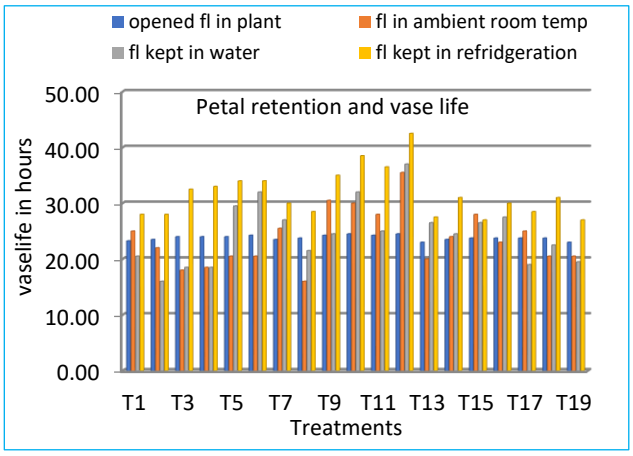

Fig 5 Impact of fertigation, microbial consortium and bio-inoculants on Petal retention and vase life

Based on the observations on the various physiological parameters and its impact on the flower petals retention and vase life, we could observe the higher impact in the petal retention with 24.50, 35.50, 37.00 and 42.50 hours respectively under the situations of flowers left in plant itself, harvested flowers kept in the room temperature, flowers kept in water and flowers kept under refrigeration were recorded in the treatment (T_{12}) which received the application of 100 percentage of recommended dose of fertilizer through fertigation (RDFTF) along with MC @ 12.5 kg ha^{-1} with 4 per cent Panchagavya and 0.5 per cent Humic 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 humic acid (24.50, 30.00, 32.00 and 38.50 hours respectively) when compared to the control (T_{19}) with the soil application of 100 per cent of RDF fertilizers (23.00, 20.50, 19.50 and 27.00 hours respectively) (Table 5, Fig 5).

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 physiological parameters viz., moisture content of flower petals, weight loss percentage, relative water content, dry matter production and higher petal retention duration and vase life of Edward Rose which will certainly add significant impact on the economic aspects for the farmers too. Higher the vase life, greater is the economic returns for the farmers.

Table 5 Impact of fertigation, microbial consortium and bio-stimulants on vase life - petal retention

Treatment	Vase life - Petal retention (hours)			
	Opened flowering in plant	Flowering in ambient room temp	Flowering kept in water	Flowering kept in refrigeration
T_1	23.25	25.00	20.50	28.00
T_2	23.50	22.00	16.00	28.00
T_3	24.00	18.00	18.50	32.50
T_4	24.00	18.50	18.50	33.00
T_5	24.00	20.50	29.50	34.00
T_6	24.25	20.50	32.00	34.00
T_7	23.50	25.50	27.00	30.00
T_8	23.75	16.00	21.50	28.50
T_9	24.25	30.50	24.50	35.00
T_{10}	24.50	30.00	32.00	38.50
T_{11}	24.25	28.00	25.00	36.50
T_{12}	24.50	35.50	37.00	42.50
T_{13}	23.00	20.00	26.50	27.50
T_{14}	23.50	24.00	24.50	31.00
T_{15}	23.75	28.00	26.50	27.00
T_{16}	23.75	23.00	27.50	30.00
T_{17}	23.75	25.00	19.00	28.50
T_{18}	23.75	20.50	22.50	31.00
T_{19}	23.00	20.50	19.50	27.00
Mean	23.80	23.74	24.63	31.71
SE(m)	0.296	2.725	3.731	1.344
SE(d)	0.418	3.854	5.276	1.901
CD (p= 0.05)	0.885	8.16	NS	4.025

LITERATURE CITED

1. Darras A. 2021. Overview of the dynamic role of specialty cut flowers in the international cut flower market. *Horticulturae* 7(3): 51.
2. Božanić Tanjga B, Ljubojević M, Đukić A, Vukosavljev M, Ilić O, Narandžić T. 2022. Selection of garden roses to improve the ecosystem services they provide. *Horticulturae* 8(10): 883.
3. Dhanaraju M, Chenniappan P, Ramalingam K, Pazhanivelan S, Kaliaperumal R. 2022. Smart farming: Internet of things (IoT)-based sustainable agriculture. *Agriculture* 12(10): 1745.
4. Bahirat JB, Jadhav HG. 2011. Identifying channels of marketing and price spread for rose in Satara district, Maharashtra. *Int. Res. Jr. Agri. Eco. Stat*. 2(2): 219-222.
5. Panse VG, Sukhatme PV. 1985. *Statistical Methods for Agricultural Workers*. ICAR, New Delhi. pp 134-192.
6. Punitha A, Jawaharlal M. 2021. Effect of pulsing treatment for prolonging vase life in carnation. *International Horticulture Conference on NextGen-Hort* 2021 - Abstracts. pp 221.
7. Carpenter WJ, Rasmussen HP. 1973. Water uptake rates by cut roses (*R. hybrida*) in light and dark. *Jr. Amer. Soc. Hort. Science* 98: 303-313.
8. Paull RE, Goo C. 1985. Ethylene and water stress in the senescence of cut flowers of anthurium. *Jr. Amer. Soc. Hort. Science* 110(1): 84-88.
9. Paull RE, Chen NJ, Deputy J. 1985. Physiological changes associated with senescence of cut flowers of anthurium. *Jr. Amer. Soc. Hort. Science* 110(2): 156-162.
10. Xue QH, Lin R. 1999. Senescence of China rose cut flower and its relationship to moisture content lipid peroxidation and protective enzyme activity. *Jr. Fujian Agric. University* 28(3): 304-308.
11. Trippi V, Paulin A. 1984. The senescence of cut carnation: A phasic phenomenon. *Physiology Plant* 60: 221-226.
12. Eze J, Mayak S, Thompson J, Dumbroff E. 1986. Senescence in cut carnation flowers: temporal and physiological relationships among water status, ethylene, abscisic acid and membrane permeability. *Physiologia Plantarum* 68(2): 323-328.
13. Woodson WR, Handa AK. 1987. Changes in protein patterns in vivo protein synthesis during pre-senescence and senescence of hibiscus petals. *Jr. Plant. Physiology* 128: 67-75.
14. Stead AD, Moore KG. 1983. Studies on flower longevity in digitalis: The role of ethylene in corolla abscission. *Planta* 157(1): 15-21.
15. Nichols R. 1966. Ethylene production during senescence of flowers. *Jr. Hort. Science* 41: 279-290.
16. Nichols R. 1971. Induction of flower senescence and gynoecium development in the carnation (*Dianthus caryophyllus*) by ethylene and 2-chloroethyl phosphonic acid. *Jr. Hort. Science* 46: 323-332.
17. Sharma V. 1981. Biochemical changes accompanying petal development in rose (*Rosa damascena*). *Plant Biochemical Journal* 8(1): 13-16.