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To Study the Effect of Different Preservatives on Vase Life of Rose

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ABSTRACT: A field experiment entitled "Studies on Evaluation of different Dutch Rose varieties under Naturally Ventilated Polyhouse condition" was conducted during two consecutive years 2021 - 22 and 2022 - 23 in Rabi season at village –Mohandi, District – Mahasamund and Laboratory work done at Department of Floriculture and Landscape Architecture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Krishak Nagar Raipur (C.G.). The present experiment with 9 treatment combinations with 3 preservative solutions along with 3 varieties with three replications, the experiment was laid out in Factorial Randomized Block Design (FRBD). Preservative having P1 $Al_2 (SO_4)_3$ 400 ppm + Sucrose 4 %, P2 Chitosan 50 ppm + Sucrose 4 %, P3 Control. Varieties V1 Top Secret, V2 Jumilia and V3 Avalanche. The interaction of preservatives & varieties of maximum fresh weight (48.45,45.53,40.32,24.34 g), Maximum solution uptake (37.95, 30.04, 23.71, 13.82 ml), Maximum petal membrane stability index (42.95,34.78,24.61 %), Maximum relative water content of leaf (89.32 %) Maximum vase life (13.70 days) were recorded in Top Secret+ $Al_2 (SO_4)_3$ 400 ppm + Sucrose 4% (T1). The results of study revealed that interaction of preservatives & varieties of minimum fresh weight (35.23,31.34,28.38,11.12 g), minimum solution uptake (21.91, 17.82, 14.45, 5.29 ml), minimum petal membrane stability index (32.16,21.01,11.85 %), minimum relative water content of leaf (77.71 %) minimum vase life (9.49 days) were recorded in Avalanche+ Control (T9). Based on the present findings it can be concluded that varieties Top secret (T1) performed best followed by Jumelia (T2) and Avalanche (T3) in terms of bud length, bud diameter, flower stalk length, flower diameter and stem girth while Peach Avalanche recorded minimum floral character, under Chhattisgarh plain condition. The maximum vase life (13.70 days) of rose cut flowers was observed in the preservative solution containing aluminiumsulphate at 400 ppm. concentration followed by (T2) and (T3) increased the solution uptake, solution loss of cut roses and gained more fresh weight.

Keywords: Dutch Rose, Top Secret, preservatives, vase life and varieties.

INTRODUCTION

India has an ancient heritage when it comes to floriculture. A consistent increase in demand for cut and potted flowers has made floriculture as one of the important commercial trades in Indian Agriculture (Gauraha *et al.,* 2018). The demand for cut flowers is increasing day by day with the increasing standard of living, aesthetic sense and awareness in the people. It is an important floriculture product, among all the cut flowers, rose ranks first in the International flower market (Shivaprasad *et al*., 2016). The area under horticulture crop also rose 25.6 million hectare from 25.43 million hectare. The Maharashtra, Tamil Nadu, Karnataka, Chhattisgarh and West Bengal are the most rose farming project state in India. In the C.G. state area under floriculture is 13,089 ha^{-1} with the production of 2,29868 MT. approximately in the 2020-21. The successful commercial rose farming process mostly depends on the varieties of rose flower. India is bestowed with several agro climatic zones, Roses can be grown throughout the year in the India. Around 80% of floriculture area is occupied by states like Tamil nadu, Karnataka, Andhra Pradesh, West Bengal, Haryana, Uttar Pradesh and Delhi. Rose is the principle cut flower grown all over the country.

In India, major rose growing belts are Pune, Bangalore and Delhi. These are setup in and around Bangalore, Pune, Hyderabad and Delhi mainly of rose. So the expansion of the area is much felt in the entire viable region to increase the production. In Chhattisgarh area under flower was 7130.4 ha and Mahasamund district and surrounding areas adjacent to Raipur and Durg have been identified as possibly the best region, suited for cut flower production. Rose has become a part and parcel of the life. Rose are grown on a large scale for cut flowers and on small scale for planting shrubs,

bushes, standard rose, climbers ramblers, edges and rockeries in the garden and pot plants for decorating the houses. There is a considerable demand for loose flowers for making garlands, bouquets and floral decoration. Rose is a perennial erect shrub with beautiful sweet – scented flowers grown for various purposes, such as garden flowers, for aesthetic value, cut flowers for decoration and loose flowers for garland and also for making various products such as rose oil, rose water, gulkand and rose attar etc (Subiya *et al.,* 2017).

Rose ranks first among the top ten cut flowers in the international flower market. It is a symbol of love, adoration and innocence and it occupies a prominent position in the tradition, religious and social culture of every country in the world. It is one of the natures beautiful creations and is universally known as "Queen of Flower" and belongs to the family Rosaceae. With the basic chromosome number n=7 and cultivated rose with chromosome number 2n = 4x = 28. Rose, botanically identified as *Rosa spp*., is indigenous to Europe and is widely distributed in Europe. The genus Rosa consists of about 120 species, out of which only eight species are cultivated *viz*., *Rosa chinensis, Rosa damascena, Rosa foetida, Rosa gallica, Rosa gigantea, Rosa moschata, Rosa multiflora* and and *Rosa wichuriana* (Soujanya *et al.,* 2018). There are several varieties of rose classified according to colour, size, type and use etc. The varieties as per use are oil- *Rosa damascena*, Gulkand - *Rosa damascene* and *Rosa chinensis*. Botanically, rose is an ornamental shrub/bush with upright or climbing stems usually prickly. Leaves are alternate, compound, oddly pinnate with stipules adherent to the leaf stalk and flowers are solitary (single) or in corymbs (cluster). Calyx is five lobed, either simple or compound. Petals & Sepals are generally five; however *Rosa sericea* has only four petals and sepals. Carpels are many, inserted at the base of the calyx tube and with simple projecting style and stigma. Fruits are known as hips, contain many seeds and are rich in Vit. C, A1, B2, K & E. Seeds are hard and fresh seed have dormancy (Shahrin *et al.,* 2015).

Vase life quality of cut flowers is one of the most crucial factors for customer satisfaction and repeat purchase. Flowers grown for the ornamental market must be of high quality to extend cut flowers postharvest longevity and increase marketability and commercial value. Several preservatives are used to enhance the postharvest life of cut flowers. Different solutions containing different concentrations of sugar, citric acid, 8- Hydroxy Quinoline Sulfate (8-HQS), S-Hydroxy Quinoline Citrate (8-HQC), silver nitrate, aluminium sulphate etc. are used to prolong the post harvest life of cut flowers. Considering the potential of Dutch roses in dry flower trade, the present studies were undertaken to evaluate the colour of dried Dutch rose flowers of different drying methods using a colorimeter Minolta CR-10. It was selected as an improved colour measurement to more accurately describing the colour.

MATERIAL AND METHODS

The field experiment was carried out during the year 2021-2022 and 2022-23 under Naturally Ventilated Polyhouse at Hi-Tech Horticulture Unit, village – Mohandi, District –Mahasamund and Department of Floriculture and Landscape Architecture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Krishak Nagar Raipur (C.G.). The soil of experimental site possesses sandy loam texture. With 9 treatment combinations with 3 preservative solutions along with 3 varieties with three replications, the experiment was laid out in Factorial Randomized Block Design (FRBD). Preservative having P1 $Al_2 (SO_4)_3$ 400 ppm + Sucrose 4 %, P2 Chitosan 50 ppm + Sucrose 4 %, P3 Control. VarietiesV1 Top Secret, V2 Jumilia and V3 Avalanche. To collect the data, flask with solution and with or without flower stalk were weighed every day and from these data fresh weight, solution uptake and petal membrane stability index were worked out.

RESULT AND DISCUSSION

A. Fresh weight of flower (g)

Data collected to find out the fresh weight presented in Table – 1 and graphically illustrated in Fig. 1. During the first year of observation in the 3rd, 6th, 9th, & 12th day, the P_1 (Al_2 $(SO4)_3$ 400 ppm + Sucrose 4 %) resulted maximum fresh weight (45.41, 42.35, 36.25, & 22.54 respectively). Among all the variety V_1 (Top Secret) recorded maximum fresh weight (42.81, 39.32, 34.12, & 19.05 respectively). Highest fresh weight was recorded (47.64, 44.16, 38.23 & 24.5) under (T_1) Top Secret + Al_2 $(SO_4)_3$ 400 ppm + Sucrose 4 % respectively.

During the second year of observation in the 3rd, 6th, 9th, & 12th day, the P_1resulted maximum fresh weight (46.28, 43.38, 39.41, & 23.53 respectively). Among all the varietal V_1 recorded maximum fresh weight (44.32, 40.45, 36.23, & 20.12 respectively). Interaction between preservative and varietal had significant affects the vase life. Highest fresh weight was recorded (49.32, 46.23, 41.31 & 25.16) under T_1 (P_1V_1) respectively. Pooled mean recorded for both year under 3rd, 6th, 9th, & 12th day highest was recorded in P_1 (46.16, 42.34, 37.83, & 22.53). Among all varietal highest was recorded in V_1 (43.34, 39.78, 35.02, & 19.05). Interaction effect for fresh weight on 3rd, 6th, 9th, & 12th day was found highest under T_1 (48.45, 45.53, 40.32, & 24.34 respectively) in P_1V_1 (Top Secret + Al_2 $(SO_4)_3$ 400 ppm + Sucrose 4 %). Maximum fresh weight was recorded in (Top Secret + Al_2 $(SO_4)_3$ 400 ppm + Sucrose 4 %) and was least in Avalanche Control. Bhattacharjee (1998) reported that use of sucrose in the vase solution influenced water uptake, transpiration loss of water, maintained better water relations there by improved fresh weight of the flower. Similar finding reported by Luo *et al*. (2003) in cut carnation flowers Kazaz *et al.* (2019).

Table 1: Fresh weight of Rose variety.

Tr.		Fresh weight (g)											
		2021-22				2022-23				Pooled mean			
		Preservative											
		3	6	9	12	3	6	9	12	3	6	9	12
	P_1	45.41	42.35	36.25	22.54	46.28	43.38	39.41	23.53	46.16	42.34	37.83	22.53
	P_2	41.12	37.31	32.34	17.21	42.14	38.32	33.37	17.88	41.66	37.56	33.18	17.12
	P_3	36.79	32.75	29.18	12.36	37.79	34.42	30	13.25	37.13	33.53	29.45	12.56
	SE(m)	0.94	0.71	0.73	0.624	0.57	0.81	0.78	0.67	0.58	0.71	0.73	0.62
	C.D. at 5%	2.02	2.17	2.22	1.88	1.74	2.4	2.36	2.04	1.74	2.14	2.12	1.87
		Variety											
	V_1	42.81	39.32	34.12	19.05	44.32	40.45	36.23	20.12	43.34	39.78	35.02	19.05
	V_2	41.53	37.28	32.37	17.44	42.43	38.28	34.46	18.22	41.78	38.38	33.56	17.45
	V_3	39.72	35.53	31.42	15.79	40.13	36.81	32.44	16.21	39.67	26.12	31.78	15.78
	SE(m)	0.94	0.719	0.73	0.62	0.57	0.81	0.78	0.67	0.58	0.71	0.73	0.62
	C.D. at 5%	2.02	2.17	2.22	1.88	1.74	2.4	2.36	2.04	1.74	2.14	2.12	1.87
		Interaction Effect(P×V)											
T_1	P_1V_1	47.64	44.16	38.23	24.5	49.32	46.23	41.31	25.16	48.45	45.53	40.32	24.34
T_2	P_1V_2	45.43	42.36	36.29	22.86	46.65	43.26	39.46	23.46	46.34	43.16	38.16	22.56
T_3	P_1V_3	43.23	40.53	34.33	20.43	44.06	41.78	36.53	21.43	44.89	41.45	35.23	20.23
T_4	P_2V_1	42.16	38.23	33.79	18.66	43.23	39.54	35.73	19.76	43.67	39.34	34.5	18.12
T_5	P_2V_2	41.36	37.76	32.67	16.63	42.13	38.39	33.83	17.36	42.09	38.87	32.83	16.68
T_6	P_2V_3	39.71	35.23	31.39	15.83	40.16	36.32	32.26	16.83	40.34	36.64	32.56	15.78
T_7	P_3V_1	38.39	34.36	30.23	14.23	39.33	35.54	31.13	14.36	38.73	35.14	30.53	14.23
T_8	P_3V_2	37.12	33.53	29.13	12.85	38.13	34.36	30.23	13.13	37.36	34,13	29.67	12.68
T_9	P_3V_3	35.34	30.13	27.56	11.16	35.26	32.03	28.43	11.56	35.23	31.34	28.38	11.12
	SE(m)	**1.16**	**1.25**	**1.27**	**1.08**	**1.02**	**1.417**	**1.52**	**1.17**	**1.01**	**1.23**	**1.22**	**0.62**
	C.D. at 5%	**3.42**	**3.71**	**3.82**	**3.69**	**3.01**	**4.21**	**4.05**	**3.57**	**3.01**	**3.71**	**3.68**	**3.24**

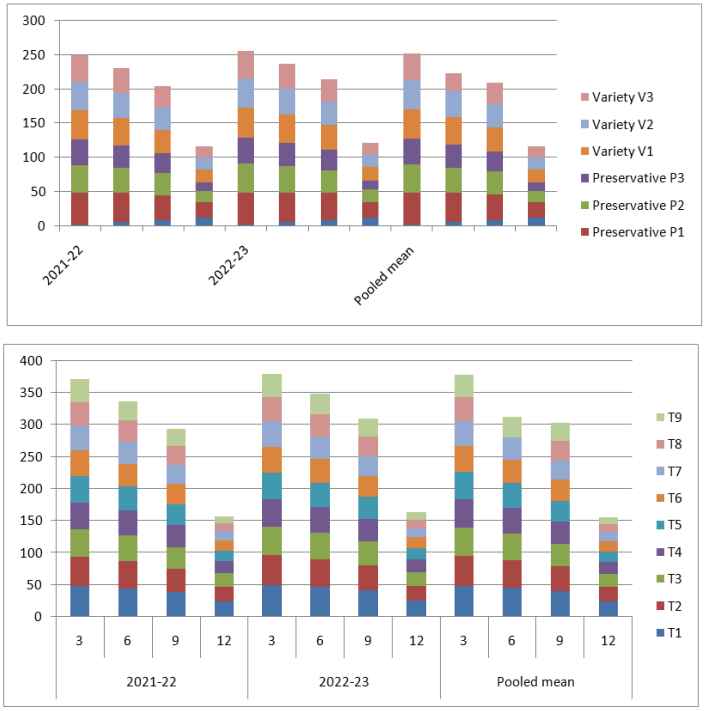


Fig. 1. Fresh weight.

B. Solution uptake (ml/flower)

Data collected to find out the solution uptake presented in Table 2 and graphically illustrated in Fig. 2. Significant differences were observed among different rose variety.

During the first year of observation in the 3rd, 6th, 9th, & 12th day, the P_1 (Al_2 $(SO_4)_3$ 400 ppm + Sucrose 4 %) resulted maximum solution uptake (33.34, 27.87, 21.47, & 10.97 respectively). Among all the variety V_1 (Top Secret) recorded maximum solution uptake (31.08, 24.37, 19.47, & 9.47 respectively). Interaction between

preservative and variety had significant affects the vase life. Highest solution uptake was recorded (37.08, 29.66, 22.88 & 13.04) under (Top Secret + $Al_2 (SO_4)_3$ 400 ppm + Sucrose 4 % (T_1) respectively.

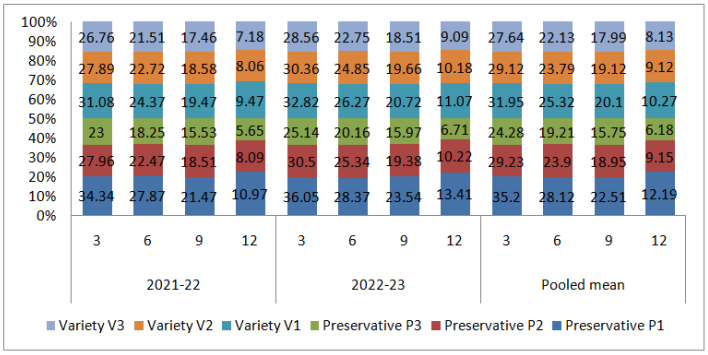
During the second year of observation in the 3rd, 6th, 9th, & 12th day, the P_1 resulted maximum solution uptake (36.05, 28.37, 23.54, & 13.41 respectively). Among all the varietal V_1 recorded maximum solution uptake (32.82, 26.27, 20.72, & 11.07 respectively). Interaction between preservative and varietal had significant affects the vase life. Highest solution uptake was recorded (38.82, 30.42, 24.54 & 14.61) under T_1 (P_1V_1) respectively.

Pooled mean recorded for both year under 3rd, 6th, 9th, & 12th day .Highest was recorded in P_1 (34.22, 27.22, 21.55,16.66 & 11.83) . Among all varietal highest was recorded in V_1 (30.88, 24.05, 19.05, 14.22 & 9.94). Interaction effect for solution uptake on 3rd, 6th, 9th, & 12th day was found highest under T_1 (37.95, 30.04, 23.71, & 13.82 respectively) in P_1V_1.

Maximum solution uptake was recorded in (Top Secret + $Al_2 (SO_4)_3$ 400 ppm + Sucrose 4 %) and was least in Avalanche Control. Rogers, 1973 reported that addition of sucrose to holding solution might have lead to increased uptake of the holding solution. Liao *et al.* (2001) observed that with $Al_2 (SO_4)_3$ water uptake in cut lisianthus was increased $Al_2 (SO_4)_3$ is the most important bactericide which as same as citric acid have positive effect water uptake rate consequence in anthesis. Hassanpour *et al.* (2004) reported that Al_2SO_4 acidifies vase solution, diminishes bacterial proliferation and enhances water uptake**.**

Table 2: Solution uptake of Rose variety.

Tr.		Solution uptake (ml/flower)											
		2021-22				2022-23				Pooled mean			
		Preservative											
		3	6	9	12	3	6	9	12	3	6	9	12
	P_1	34.34	27.87	21.47	10.97	36.05	28.37	23.54	13.41	35.2	28.12	22.51	12.19
	P_2	27.96	22.47	18.51	8.09	30.5	25.34	19.38	10.22	29.23	23.9	18.95	9.15
	P_3	23	18.25	15.53	5.65	25.14	20.16	15.97	6.71	24.28	19.21	15.75	6.18
	SE(m)	0.82	0.68	0.47	0.33	0.83	0.68	0.57	0.43	0.69	0.57	0.36	0.31
	C.D. at 5%	2.48	2.04	1.42	0.99	2.5	2.03	1.73	1.29	2.07	1.7	1.09	0.94
		Variety											
	V_1	31.08	24.37	19.47	9.47	32.82	26.27	20.72	11.07	31.95	25.32	20.1	10.27
	V_2	27.89	22.72	18.58	8.06	30.36	24.85	19.66	10.18	29.12	23.79	19.12	9.12
	V_3	26.76	21.51	17.46	7.18	28.56	22.75	18.51	9.09	27.64	22.13	17.99	8.13
	SE(m)	0.82	0.68	0.47	0.33	0.83	0.68	0.57	0.43	0.69	0.57	0.36	0.31
	C.D. at 5%	2.48	2.04	1.42	0.99	2.5	2.03	1.73	1.29	2.07	1.7	1.09	0.94
		Interaction Effect(P×V)											
T_1	P_1V_1	37.08	29.66	22.88	13.04	38.82	30.42	24.54	14.61	37.95	30.04	23.71	13.82
T_2	P_1V_2	33.03	27.93	21.08	10.53	35.22	28.73	23.21	13.46	34.12	28.33	22.14	11.96
T_3	P_1V_3	32.92	26.03	20.47	9.35	34.13	25.96	22.87	12.22	33.52	25.99	21.67	10.78
T_4	P_2V_1	30.69	24.326	19.28	8.71	32.62	26.69	20.04	10.99	31.65	25.51	19.66	9.85
T_5	P_2V_2	26.96	22.21	18.73	8.046	30.16	25.066	19.94	10.53	28.56	23.63	19.34	9.29
T_6	P_2V_3	26.24	20.89	17.51	7.51	28.72	24.26	18.18	9.143	27.48	22.57	17.84	8.33
T_7	P_3V_1	25.46	19.12	16.25	6.68	27.02	21.706	17.59	7.61	26.24	20.41	16.92	7.14
T_8	P_3V_2	23.69	18.03	15.94	5.62	25.7	20.76	15.82	6.61	24.62	19.4	15.88	6.12
T_9	P_3V_3	21.13	17.61	14.41	4.67	22.7	18.02	14.49	5.92	21.91	17.82	14.45	5.29
	SE(m)	**1.43**	**1.17**	**0.82**	**0.57**	**1.44**	**0.68**	**0.57**	**0.74**	**1.19**	**0.57**	**0.36**	**0.31**
	C.D. at 5%	**4.29**	**3.53**	**2.4**	**1.72**	**4.33**	**3.5**	**3.77**	**2.23**	**3.59**	**2.96**	**1.89**	**0.94**



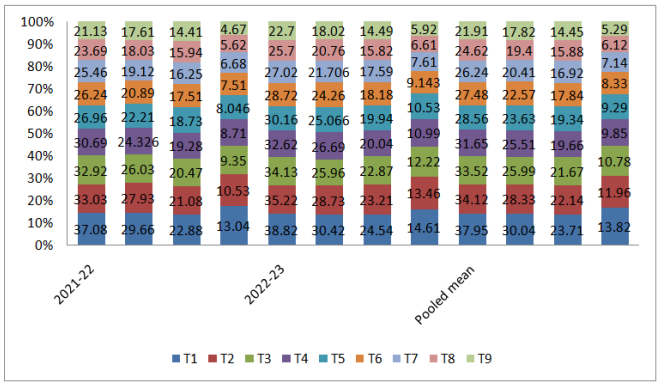


Fig. 2. Solution uptake of rose variety.

C. Petal membrane stability index (%)

The data perusing to Petal membrane stability index of rose variety with chemical treatment has been presented in Table 3 and graphically illustrated in Fig. 3. Significant differences were observed among different rose variety.

During the first year of observation in the 1st, 3rd, & 5th day, the (Al_2 $(SO_4)_3$ 400 ppm + Sucrose 4 %) P_1resulted maximum petal membrane stability index (41.62, 33.25, & 21.63 respectively). Among all the variety (Top Secret)V_1 recorded maximum petal membrane stability index(38.25, 28.92, & 18.47 respectively). Interaction between preservative and variety had significant affects the vase life. Highest petal membrane stability index was recorded (42.73, 34.40, & 23.40) under (Top Secret + Al_2 $(SO_4)_3$ 400 ppm + Sucrose 4 %.) T_1 (P_1V_1) respectively.

During the second year of observation in the 1st, 3rd, & 5th day, the P_1 resulted maximum petal membrane stability index(42.47, 33.07, & 23.47 respectively). Among all the varietal V_1 recorded maximum petal membrane stability index (39.45, 30.23, & 20.23 respectively). Interaction between preservative and varietal had significant affects the vase life. Highest petal membrane stability index was recorded (32.50, 22.16 & 12.16) under (T_1) P_1V_1 respectively.

Pooled mean recorded for both year under 1st, 3rd, & 5th day. Highest was recorded in P_1 (42.05, 33.50, & 22.56 respectively). Among all varietal highest was recorded in V_1 (38.86, 12.51, & 19.36). Interaction effect for petal membrane stability index on 1st, 3rd, & 5th day was found highest under T_1 (42.95, 34.78, & 24.61 respectively) in P_1V_1.

Maximum Petal membrane stability index was recorded in (Top Secret + Al_2 $(SO_4)_3$ 400 ppm + Sucrose 4 %) and was least in Avalanche Control. Blum and Ebercon (1980) reported that the membrane stability index (MSI) is another physiological index that has been widely used to evaluate drought and heat tolerance. Similar observation was reported by Farahat *et al.* (2014); Dastborhan & Ghassemi-Golezani (2015); Khan *et al.* (2015); Hassani *et al.* (2020).

Table 3: Petal membrane stability index of Rose variety.

Treatments		Petal membrane stability index (%)								
		2021-22			2022-23			Pooled mean		
		Preservative								
		1	3	5	1	3	5	1	3	5
	P_1	41.62	33.3	21.63	42.47	33.7	23.47	42.05	33.5	22.56
	P_2	37.12	26.78	16.9	38.47	28.44	18.47	37.8	27.63	17.69
	P_3	32.36	22.03	12.58	33.62	23.95	13.95	32.99	22.99	13.27
	SE(m)	0.41	0.71	0.25	0.39	0.47	0.33	0.29	0.44	0.18
	C.D. at 5%	1.25	2.1	0.76	1.18	1.42	1.01	0.87	1.34	0.56
		Variety								
	V_1	38.25	28.92	18.47	39.45	30.23	20.23	38.86	12.51	19.36
	V_2	37.03	27.7	17.03	38.21	28.65	18.76	37.63	12.52	17.9
	V_3	35.82	25.5	15.61	26.91	27.24	16.91	36.37	11.31	16.26
	SE(m)	0.41	0.71	0.25	0.39	0.47	0.33	0.29	0.44	0.18
	C.D. at 5%	1.25	2.1	0.76	1.18	1.42	1.01	0.87	1.34	0.56
		Interaction Effect(P×V)								
T_1	**P_1V_1**	42.73	34.4	23.4	43.16	35.16	25.83	42.95	34.78	24.61
T_2	**P_1V_2**	41.85	33.51	21.51	42.6	33.6	23.26	42.22	33.55	22.39
T_3	**P_1V_3**	40.3	32	20	41.66	32.33	21.33	40.98	32.16	20.66
T_4	**P_2V_1**	38.56	28.56	18.23	40.4	30.06	19.4	39.48	29.31	18.81
T_5	**P_2V_2**	37.16	27.16	17.16	38.46	28.13	18.8	37.81	27.65	17.98
T_6	**P_2V_3**	35.63	24.63	15.3	36.56	27.23	17.23	36.1	25.93	16.26
T_7	**P_3V_1**	33.46	23.8	13.8	34.8	25.46	15.46	34.13	24.63	14.63
T_8	**P_3V_2**	32.1	22.43	12.43	33.56	24.23	14.23	32.83	23.33	13.33
T_9	**P_3V_3**	31.53	19.86	11.53	32.5	22.16	12.16	32.016	21.01	11.85
	SE(m)	**0.72**	**1.21**	**0.44**	**0.68**	**0.33**	**0.58**	**0.505**	**0.77**	**0.32**
	C.D. at 5%	**2.17**	**3.64**	**1.33**	**2.04**	**2.46**	**1.76**	**1.51**	**2.23**	**0.97**

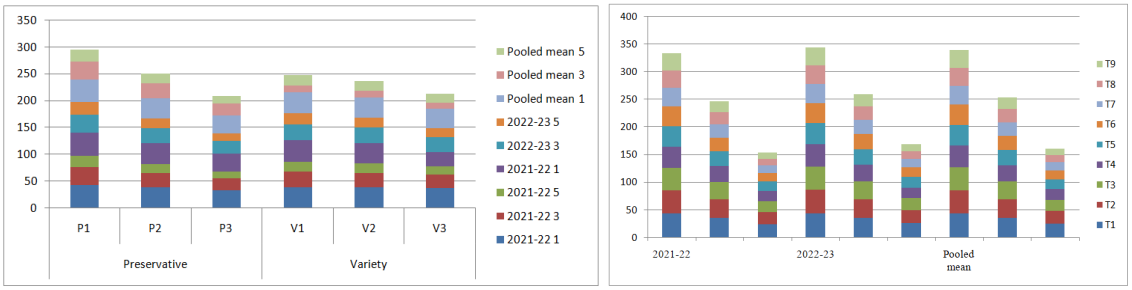


Fig. 3. Petal membrane stability index.

D. Relative water content of rose leaf (%)

The data perusing to relative water content of leaf as shown by different variety of Rose naturally ventilated polyhouse has been presented in Table 4 and graphically illustrated in Fig. 4. During the first year (2021-22) of observation in the 1st day, the P_1 ($Al_2(SO_4)_3$ 400 ppm + Sucrose 4 %)resulted maximum relative water content of leaf(84.81 %). Among all the variety V_1 (Top Secret) recorded maximum relative water content of leaf (81.67 %). Interaction between preservative and varietal had significant affects the vase life. Highest relative water content of leaf was recorded (86.72 %) under , (Top Secret + $Al_2(SO_4)_3$ 400 ppm + Sucrose 4 %.) T_1 (P_1V_1) respectively.

During the second year (2022-23) of observation in the 1st day, the P_1 resulted maximum relative water content of leaf(91.33 %). Among all the varietal V_1 recorded maximum relative water content of leaf (88.31 %). Interaction between preservative and varietal had significant affects the vase life. Highest relative water content of leafwas recorded (92.64 %) under T_1 (P_1V_1) respectively.

Pooled mean recorded for both year under 1st day. Highest was recorded in P_1 (88.14 %). Among all varietal highest was recorded in V_1 (85.12, %) Interaction effect for relative water content of leaf on 1st day was found highest under T_1 (89.32) in P_1V_1. Maximum relative water content was recorded in Top Secret and was least in Peach Avalanche. Variation in relative water content of leaf might be genetic make-up and environmental conditions prevailing during the time of experiment. Anjum *et al.* (2011) reported that leaf relative water content reflects the metabolic activity of tissues and used as a meaningful index for dehydration tolerance.

Table 4: Relative water content of rose leaf.

Treatments		Relative water content of rose leaf (%)		
		2021-22	**2022-23**	**Pooled mean**
		Preservative		
		1	**1**	**1**
	P_1	84.81	91.33	88.14
	P_2	80.24	87.16	83.63
	P_3	75.12	82.62	79.21
	SE(m)	0.48	0.44	0.33
	C.D. at 5%	1.46	1.34	1.01
		Variety		
	V_1	81.67	88.31	85.12
	V_2	80.22	87.19	83.73
	V_3	78.45	85.45	82.21
	SE(m)	0.48	0.44	0.33
	C.D. at 5%	1.46	1.34	1.01
		Interaction Effect(P×V)		
T_1	**P_1V_1**	86.72	92.64	89.32
T_2	**P_1V_2**	85.04	91.12	88.29
T_3	**P_1V_3**	82.96	90.16	86.21
T_4	**P_2V_1**	81.42	88.64	84.32
T_5	**P_2V_2**	80.12	87.15	83.64
T_6	**P_2V_3**	79.84	86.25	82.31
T_7	**P_3V_1**	77.47	84.34	80.09
T_8	**P_3V_2**	75.72	83.18	79.31
T_9	**P_3V_3**	74.54	80.66	77.71
	SE(m)	**0.89**	**0.77**	**0.58**
	C.D. at 5%	**2.53**	**2.38**	**1.85**

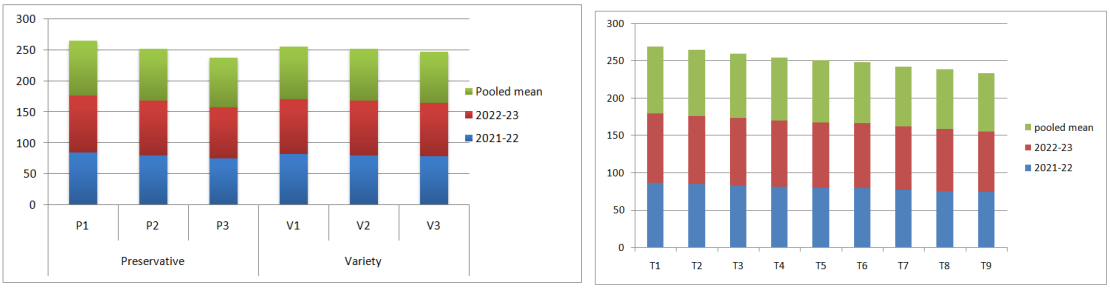


Fig. 4. Relative water content of rose leaf.

E. Vase life (days)

The data perusing to vase life days of rose variety with chemical treatment has been presented in Table 5 and graphically illustrated in Fig. 5. Significant differences were observed among different rose variety. During the first year (2021-22) of observation ($Al_2(SO_4)_3$ 400 ppm + Sucrose 4 %) P_1 resulted maximum vase life (13.04 days). Among all the variety (Top Secret) V_1 recorded maximum vase life (12.4 days). Interaction between preservative and variety had significant affect the vase life. The highest vase life was recorded (13.52 days) under (T_1) P_1V_1(Top Secret + $Al_2(SO_4)_3$ 400 ppm + Sucrose 4 %.).

During the second year (2022-23) of observation P_1resulted maximum vase life (13.47 days). Among all the varietal V_1 recorded maximum vase life (12.61 days). Interaction between preservative and varietal had significant affect the vase life. The highest vase life was recorded (13.88 days) under (T_1) P_1V_1. Pooled mean recorded for both year, the highest was recorded in P_1 (13.26). Among all varietal highest was recorded in V_1 (12.51 days).Interaction effect for vase life was found highest under T_1 (13.70) in P_1V_1. Maximum vase life was recorded in (Top Secret + $Al_2(SO_4)_3$ 400 ppm + Sucrose 4 %) and was least in Avalanche Control. Reported that (Liao *et al*., 2001) aluminiumsulphate reduces pH of the solution, effectively inhibits bacterial growth and prevents microbial clogging at the microbial cut end of the stem thus improving water uptake (Hassanpour *et al.,* 2004) reported that Al_2SO_4 acidifies vase solution, diminishes bacterial proliferation and enhances water uptake**.** Similar observation was reported by Farahat *et al*. (2014) ; Das *et al.* (2020).

Table 5: Vase life (Days) of Rose variety.

Treatments		Vase life (Days)		
		2021-22	**2022-23**	**Pooled mean**
		Preservative		
	P_1	13.04	13.47	13.26
	P_2	11.95	12.26	12.11
	P_3	10.49	10.51	10.5
	SE(m)	0.105	0.19	0.95
	C.D. at 5%	0.31	0.59	0.28
		Variety		
	V_1	12.4	12.61	12.51
	V_2	11.92	12.17	12.52
	V_3	11.16	11.46	11.31
	SE(m)	0.105	0.19	0.95
	C.D. at 5%	0.31	0.59	0.28
		Interaction Effect(P×V)		
T_1	**P_1V_1**	13.52	13.88	13.70
T_2	**P_1V_2**	13.90	13.44	13.26
T_3	**P_1V_3**	12.52	13.09	12.80
T_4	**P_2V_1**	12.31	12.78	12.55
T_5	**P_2V_2**	12.12	12.30	12.15
T_6	**P_2V_3**	11.54	11.70	11.62
T_7	**P_3V_1**	11.38	11.17	11.27
T_8	**P_3V_2**	10.68	10.77	10.72
T_9	**P_3V_3**	9.41	9.58	9.49
	SE(m)	0.18	0.33	0.16
	C.D. at 5%	0.55	1.01	0.49

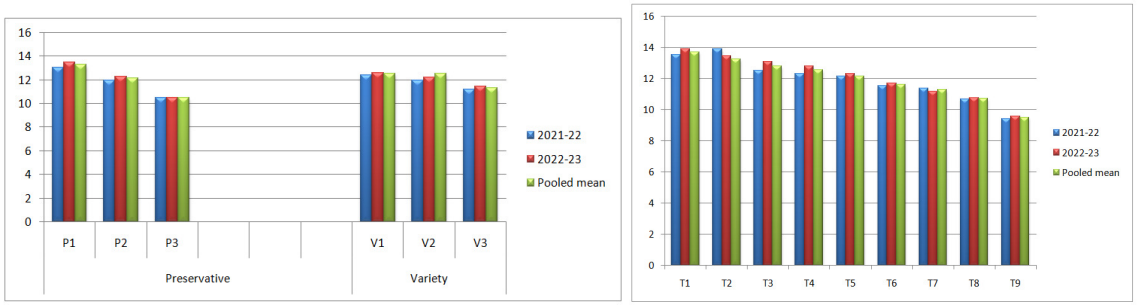


Fig. 5. Vase life (days).

CONCLUSIONS

From the present investigation, it can be concluded that the interaction of preservatives & varieties of maximum fresh weight (48.45,45.53,40.32,24.34 g), Maximum solution uptake (37.95, 30.04, 23.71, 13.82 ml), Maximum petal membrane stability index (42.95,34.78,24.61 %), Maximum relative water content of leaf (89.32 %) Maximum vase life (13.70 days) were recorded in Top Secret+ $Al_2 (SO_4)_3$ 400 ppm + Sucrose 4% (T1).

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Conflict of Interest. None.

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