NUTRIENT REMOBILIZATION IN THE LEAF TISSUES AND POSTHARVEST LIFE OF "RAKTAGANDHA" ROSES (*Rosa hybrida*) AS AFFECTED BY PLANT GROWTH REGULATORS

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Prehavest application of growth regulators like Benzyladenine (BA), Gibberellic acid (GA3) and Indoleacetic acid(IAA) as foliar sprays could improve the postharvest life of cut rose (Rajan, 1994). Foliar sprays of CCC and B-9 (SADH) at 2000 or 4000 ppm on seven cultivars of *Rosa hybrida* L. could improve vase life of cut roses (Bhattacharjee and Bose, 1997). Information on the influence of preharvest application of growth regulating chemicals like CCC, Ethrel and SADH affecting the postharvest life of cut roses is meager. Experimental evidences on nutrient content in roses as influenced by the spray of CCC, Ethrel and SADH are not available. However, effect of CCC treatment increasing the leaf nutrient content of tomato plants (Hassan et al., 1991), *Jasminum multiflorum* (Murali and Gowda, 1988) and *Jasminum sambac* (Gowda and Gowda, 1990) have been reported. The present investigation was undertaken in order to study nutrient remobilization in leaf tissues as well as postharvest life of *Rosa hybrida* L. cv "Raktagandha" as influenced by preharvest foliar spray of plant growth regul;ators.

Three years old plants of uniform size and vigour of *Rosa hybrida* L.cv "Raktagandha" which were raised initially by budding on *Rosa indica* cv Oorata, planted at a spacing of 40cm away from each were chosen for the experiment. The plants were pruned uniformly to a length of 45 cm from the bud union in the middle of October 1991 retaining fourshoots/plant. A fertilizer dose consisting of 5 gN, 8 g P_2O_5 and 6 g K_2O per plant was applied after pruning. 2.5 Kg of F.Y.M. was also added per plant along with the chemical fertilizer. All the cultural operations were carried out uniformly. Three weeks after pruning (second week of November 1991) the plants were sprayed with SADH and Ethrel each at 500 and 1000 ppm and CCC at 1000 and 2000 ppm. Control plants were sprayed with distilled water. The spray was repeated again two months after the first spray (January 1992). There were seven treatments which were replicated 5 times in a randomized block design. The experimental unit consisted of a single bed with 4 matured plants per treatment and there were altogether 20 plants for each treatment.

Cut roses were harvested when one petal started unfurling from tip and all sepals become well spread. Harvesting was performed in the morning at 7 a.m. with a stem length of 23-25 cm. Soon after harvest, the stem ends were dipped in fresh cold water and were transferred to laboratory for vase life study. The stems were recut to a uniform length of 20 cm and leaves below the 4th leaf from the topwere removed and the stem end of each flower was dipped in 60 ml of distilled water contained in a test tube. Additional distilled water was added to ensure continual dipping of the stem ends in distilled water throughout the vase life study. Vase life was considered over when the outer petals wilted or showed blueing or appearance of bent neck occurred. Layout of vase life study of cut "Raktagandha" roses in laboratory was a continuation of the field experiment. Four flowers were used per replication for vase life study. The temperature and relative humidity of the laboratory during the experiment were averaged at 21.630C (maximum and 15.960C (minimum) and 69.76% R.H.

Leaf samples were collected 15 days after the second foliar spray of growth regulators from flowering shoots avoiding the top most two leaves and leaves below the 8th leaf. Dried and powderedleaf samples were utilized for the analysis of the nutrients. N was analysed by using Kjeltect auto analyzer following the

methods described by Bremner and Mulvaney (1982), P in the diacid digest was estimated by following Vanadomolybdfophosphoric yellow colour method (Jackson, 1973). K in diacid digest was estimated using Coming Flame Photometer manufactured by M/s Coming Ltd. Halstead Essex, England.Four micronutrients namely Zn, Fe, Mn and Cu were estimated in the diacid on an Atomic Absorption Spectrophotometer (GBC 904 AA model). Data under different characters were subjected to statistical analysis following analysis of variance technique as described by Chandel (1990).

Among the growth regulators foliar sprays, CCC at 1000 ppm, had a remarkable effect in prolonging the vase life of cut roses followed by Ethrel (500 ppm) and SADH (1000 ppm) over the control (Table 1). Foliar spray of CCC at 1000 ppm markedly improved cut flower quality which has significantly enhance flower diameter, increased water uptake and recorded minimum loss in fresh weight at senescenc. CCC is known for its promotion of intense chlorophyll formation, increased photosynthesis and strengthening of woody stem (Thomas 1982). Therefore, cut roses strengthened with more carbohydrate in stem, leaves and other flower parts resultedfrom CCC (1000 ppm) foliar spray might have contributed to lengthening the postharvest life of cut "Raktagandha" roses. Increasing in vase life of cut "Raktagandha" with foliar spray of Ethrel(500 ppm) need further research even through ethrel had been reported as a corrective growth retardent (Mehta et al, 1989). SADH has been reported to increase flower life (Buxton and Culbert, 1967) delay the sentences of cut roses and improved size of cut roses (Bhattacharjee and Bose, 1979; Bhattacharjee, 1993). Chemical growth retardants are reported to decrease ethylene production (Halevy et al., 1966) and this may be another reason for improved vase life of cut roses obtained from CCC and SADH sprayed plants. Foliar spray of SADH (1000 ppm), CCC (1000 ppm) and Ethrel (500 and 1000 ppm) had marked effect in the leaf content of N and K; whereas P content in the leaf was significantly increased with the preharvest spray of CCC and Ethrel at 1000 ppm each (Table 2). The growth regulator treatments significantly affected leaf Fe, Mn and Zn, however, leaf Cu content was not effected by any of the treatments. Foliar spray of CCC (1000 ppm) which recorded maximum vase life also resulted in marked increased in leaf content of Fe and Zn over other growth regulator treatments and control (Table 3). Foliar spray of CCC (1000 ppm) also recorded maximum leaf Mn content (150.67 ppm) though it was on par statistically with SADH (1000 ppm) and Ethrel (500 ppm). Therefore, it became evident from Table 2 and Table 3 that higher leaf N, P, K, Fe, Mn and Zn contents were associated with the longest vase life of cut "Raktagandha" roses as influenced by foliar spray of CCC at 1000 ppm. Increase in leaf nutrient content (major and minor nutrients) in tomato was noticed with CCC treatment (Hassan et al., 1991). CCC spray also increased leaf nutrient content in Jasminum spp. (Gowda and Gowda, 1990; Murali and Gowda, 1988).

Increased in nutrient content with the foliar spray of CCC and SADH may be attributed to better root growth from translocation of photosynthates from leaves. Increased photosynthesis may take place in leaves due to increased chlorophyll content in growth retardatants treated plants (Jaggard et al., 1982). Since ethrel also acts as a correlative growth retardant (Mehta et al 1989), the mode of action of nutrients uptake may be similar to the effect of growth retardants like CCC and SADH.

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Table 1. Effect of plant growth regulator sprays on the post harvest life and quality of cut "Raktagandha" roses.

Treatments (in ppm)	Total water Uptake (ml)	Loss in fresh wt. at senescence (gm)	Diameter of Flower (cm)	Vase life (days)
SADH 500	12.20	1.62	7.75	6.8
SADH 1000	15.28	1.41	8.48	8.0
CCC 1000	16.92	1.08	8.95	9.7
CCC 2000	14.00	1.44	8.16	7.7
Ethrel 500	16.57	1.22	8.59	8.12
Ethrel 1000	13.91	1.54	8.00	7.60
Control (D.W.)	13.57	2.11	7.94	7.40
'F' Test	**	**	**	**
C.D. at 5%	0.99	0.12	0.46	0.54

**Highly significant.

Table 2.Effect of plant growth regulator sprays on the leaf N,P, and K content of "Raktagandha" roses.

Treatments	Leaf content in per cent			Vase life
(in ppm)	N	P	K	(days)
SADH 500	2.38	0.23	1.19	6.82
SADH 1000	2.80	0.24	1.34	8.00
CCC 1000	2.94	0.27	1.40	9.74
CCC 2000	2.76	0.22	1.27	7.70
Ethrel 500	2.83	0.25	1.35	8.12
Ethrel 1000	2.75	0.26	1.31	7.60
Control (D.W.)	2.60	0.23	1.21	7.40
'F' Test	**	**	**	**
C.D. at 5%	0.08	0.02	0.06	0.54

**Highly significant.

Table 3.Effect of plant growth regulator sprays on the leaf Fe, Mn, Zn and Cu content of "Raktagandha" roses.

Treatments (in ppm)	Leaf content in ppm				Vase life
	Fe	Mn	Zn	Cu	(days)
SADH 500	187.07	139.33	32.00	Trace	6.82
SADH 1000	194.80	147.00	42.00	Trace	8.00
CCC 1000	209.33	150.67	54.13	Trace	9.74
CCC 2000	188.33	140.67	38.40	Trace	7.70
Ethrel 500	190.97	148.00	43.07	Trace	8.12
Ethrel 1000	187.37	143.33	41.60	Trace	7.60
Control (D.W.)	189.73	140.00	36.27	Trace	7.40
'F' Test	**	**	**		**
C.D. at 5%	14.43	6.38	4.64		0.54

**Highly significant.