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National Academy of Agricultural Science (NAAS) Rating : 3. 03

Effect of Different Micronutrient Sprays on Growth, Flower Yield and Vase Life of Rose Cv.sophia Loren

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ABSTRACT: *A field trial was conducted to study the effect of sprays of micro nutrients viz. MgSO4, MnSO4, FeSO4, B, ZnSO4 and CuSO4 at different concentrations on growth, flower yield, vase life of rose cv. Sophia Loren. The study revealed that all micronutrient sprays increased the plant height, plant spread, Leaf Area, Shoot Growth rate, number of shoots, Number of flowers, significantly. The days to first flower bud appearance (DFFBA), days to flower bud opening were significantly early compared to control. Among the different concentrations of different nutrients MgSO4 0.5%, MnSO4 0.5%, Boric acid 0.5%, ZnSO4 0.75%, and CuSO4 0.1% influenced the parameters and are found to be superior over rest of the two concentrations of respective nutrients. The highest number of flowers was recorded with MnSO4 0.5% substantial yield gain of (119.03%) over control was recorded, closely followed by boric acid 0.25% with (114.63%) increase over control. Vase life studies revealed that Boric acid 0.5% recorded highest water uptake (0.512 mg/gfw), Lowest Transpirational loss of water (TLW) (0.76ml/gfw), lowest Electrolyte % of 24.08%, maximum flower fresh weight during vase life recorded was 10.39g with ZnSO4 0.75% treatment boric acid 0.5% treatment with 10.31 g.*

Key words: *micronutrients, rose, days to first flower bud appearance, manganese sulphate, boric acid, fresh weight, vase life*

Rose (*Rosa indica*) is one of the most important flower crop in commercial flower trade. It is therefore necessary to increase flower yields. Micronutrient sprays with optimum concentrations have a role in improving flower yield and they also play important role improving the vase life. Although the requirement of micronutrients viz. Magnesium (Mg), Manganese (Mn), Iron (Fe), boron (B), Zinc (Zn) and Copper (Cu) is relatively less but their role in normal crop production is indispensible, because of their active role in plant metabolic processes, involving in cell wall development, photosynthesis, chlorophyll formation, respiration, various enzyme activities, hormone synthesis and nitrogen fixation (Das 1996). Hence an experiment was undertaken to study the influence of foliar application of different micronutrients at different concentrations on growth, flower yield and vase life of rose cv. Sofia Loren.

MATERIAL AND METHODS

The present study was carried out during 2005-2006 at the farm located at college of Agriculture, Rajendranagar, Hyderabad. The treatments consisted of 3 levels of concentrations of each nutrient viz. MgSO4 (0.5,1.0 and 1.5%), MnSO4 (0.5,1.0 and 1.5%), FeSO4 (1.0, 1.5 and2.0%), Boric acid (0.25, 0.5 and 0.75%), ZnSO4 (0.5, 0.75 and 1.0%) and ZnSO4 (0.1, 0.3 and 0.5%). The experiment was laid out in randomized block design with three replications.

The rose garden with cv. Sophia Loren plants, 2 year old plants planted with a spacing of 60X60 cm were selected for the experiment. Plants were pruned on 15th October 2005 by leaving four basal shoots with a length of 50cm. Uniform cultural practices were adopted. FYM was not applied (to avoid secondary source of micronutrients and) to get clear treatment influences. The micronutrient solutions were sprayed one month after pruning and at the time of new flush. In each plot five competitive plants were selected at random and tagged and utilized for recording the following observations.

Plant growth parameters like Plant height (cm) , Plant Spread (Cm^2), Leaf Area (cm^2), Relative Leaf growth rate (RLGR), Shoot Growth Rate (SGR),Total

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number of Shoots, Days to first flower bud appearance, Days to flower bud opening Floral parameters like total number of flowers /plant, Flower stalk length (cm), Flower diameter (cm), No. of petals / Flower, Petal size (Petal Area) (cm^2), Flower fresh Weight (g) (FFW), Flower dry weight (g) (FDW).

Flower vase life was studied in terms of water Uptake (ml/g fw) (Venkatarayappa *et al.*, 1980), Electrolyte leakage from ligules, Flower fresh weight change (FFWC). The vase life observations were made in distilled water used as holding solution in the laboratory.

The experimental data was analyzed statistically by the technique of analysis of variance (ANOVA) as applicable to Randomized Block design as suggested by Panse and Sukhatme,1985 using a computerized package to find the significance levels of each of the parameter. Critical Difference (CD) values at 5% level of significance were calculated for the parameters which were significant. Least significant difference (LSD or CD) was used for the comparison between the treatments during vase life. Based on the F-test, the non significant ((NS) values were ignored in the description of results.

RESULTS AND DISCUSSIONS

Effect of micronutrients on vegetative parameters: The data presented in table 1 showed that ZnSO4 0.75 per cent followed by CuSO4 0.3 per cent recorded significant increase in plant height by 32.27 and 29.77% respectively over control. Increase in plant height due to ZnSO4 spray might be due to synthesis of tryptophan, a precursor of Indoleacetic acid (Auxin) (Chatopadhyay 1994). Zinc influences the Auxin and nucleic acid levels in plants and activates the enzymes involved in protein synthesis (Mahesh kumar and Sen 2005).

CuSO4 0.3 per cent followed by ZnSO4 0.75 per cent recorded significant increase in plant spread by 23.6 and 20.6% respectively over control (table 1), CuSO4 0.3 per cent followed by ZnSO4 0.75 per cent also recorded significant increase in leaf area by 24.81% and 16.65% respectively over control (Table 1). Increase in plant spread and leaf area in copper treatments might be due to Copper participates in numerous physiological processes and is an essential co factor for many metalloproteins. (Das 1996).

Boric acid 0.25 per cent followed by ZnSO4 0.5 per cent recorded significant increase in total number of shoots by 90.03 and 83.74% respectively over control (Table 1). Improvement in plant growth might be due to an increase in photosynthetic and other metabolic activities which lead to an increase in various plant metabolites responsible for cell division and cell elongation. Photosynthetic reactions were accelerated in the presence of zinc and copper which increased the rate of plant growth (Hooda *et al.*, 1984).

Among the different micronutrients Boric acid at 0.25 per cent, followed by ZnSO4 at 0.5 per cent recorded 10 days earlier to flower bud appearance over control (Table1). Ganga *et al..(*2008) also reported early flower bud appearance with FeSO4 at 0.8% spray in Chrysanthemum. This might be attributed to Iron involved in the synthesis of plant hormones and influenced the duration of flowering. For delaying the flower bud appearance spraying of MgSO4 at 1.5% is useful, as it has recorded maximum number of days to first flower bud appearance.

Among the different micronutrients minimum number of days to flower bud opening was recorded with Boric acid at 0.5 per cent followed by ZnSO4 at 0.5 per cent, recorded 45.52% and 33.53% decrease in no. of days for flower bud opening over control (Table 1). Early flower bud opening in Boric acid spray may be due to its role in translocation of sugars, starches, phosphorous etc. might have utilized for better development of bud size and early flower bud opening (Das, 1996).

Floral parameters: MnSO4 0.5 per cent followed by Boric acid 0.25% per cent increased number of flowers per plant by 119.03% and 114.62% respectively over control (table 2). Sable and Dharke (1985) reported that foliar application of micronutrients with FeSO4, MnSO4 & CuSO4 resulted in profuse flowering in Rose cv. Paradise. Increase in number of flowers in MnSO4 might be due to the role of Manganese in many enzyme reactions and its role in electron transport in photosystem II. It has role in activation of Indole acetic acid protectors & Influences the Auxin levels in plants and it high concentration it may breakdown of Indoleacetic acid in plants which might have induced flowering. Jat *et al* 2007 also reported higher number of flowers with ZnSO4 0.5% in marigold. Manganese acts as a catalyst in the enzymatic activity in plant metabolism, as a micronutrient Mn regulates the growth and development and it is not replaced by any other elements (Bose *et.al* 2002).

CuSO4 at 0.3 per cent followed by ZnSO4 at 0.75 per cent recorded significant increase in flower stalk length by 50.63% and 34.92% respectively over control (Table 2). Increase in flower stalk length in CuSO4 spray may be due to the role formation of various compounds with amino acids and protease in the plant which might have increase the flower stalk length (Das, 1996).

Boric acid at 0.5 per cent followed by MnSO4 at 1.0% per cent and recorded significant increase in flower diameter by 26.45% and 23.38% respectively over control (Table 2). Increase in flower diameter in MgSO4 spray might be due to the role of B in the formation of Carbohydrates, fats and vitamins (Ganga *et al* 2008).

CuSO4 0.3 per cent and MgSO4 at 1.0 per cent recorded significant increase in number of petals by 43.69% and 40.92% (table 2), while minimum petal size was observed in treatment Boric acid 0.75% (9.69% decrease over control). The increase in flower fresh weight with MnSO4 0.5% might be due to the role of Mn in photosynthesis, Carbondioxide assimilation and nitrogen metabolism resulted in accumulation of large quantities of metabolites (Arvind Shukla *et al* 2009).

The increase in flower fresh weight in ZnSO4 treatments may be due to association of Zinc in regulating semi permeability of cell walls, thus mobilizing more water into flowers and also increased the synthesis of iron which promotes cell size and in turn increases flower weight (Agarwal & Sharma 1978).

MnSO4 at 0.5 per cent and Boric acid at 0.25 per cent recorded significant increase in flower dry weight over control by 275% and 247.5% respectively over control. The minimum flower dry weight was recorded in control(0.80g) . The increase in flower dry weight in MnSO4 treatment is due to the role of Mn in photosynthesis, Carbon dioxide assimilation and nitrogen metabolism that might have accumulated large quantities of metabolites.

vase life parameters: ZnSO4 at 0.5 per cent (0.512 mg/gfw) followed by MnSO4 at 1.5 per cent recorded maximum water uptake while the control recorded minimum water uptake (0.264 mg/gfw). Comparatively higher water uptake of water in ZnSO4 treatment may be due to higher tolerance to bacteria and thus exhibit slow development of vascular occlusion (Van Doorn *et al* 1989). FeSO4 at 1.0% (0.760 ml/gfw) followed by CuSO4 at 0.1% (0.77 ml/gfw) per cent recorded lowest transpiration loss of water while the maximum transpirational loss of water was recorded in ZnSO4 at 0.5 per cent (32.46%). MnSO4 at 0.5per cent (52.7%) followed by ZnSO4 at 0.75 per cent (24.69%) recorded lowest electrolyte leakage. It was highest in control (50.98%). ZnSO4 at 1.0% recorded maximum flower fresh weight (10.39) followed by Boric acid 0.5% (10.15) which was on par with each other (Table 3).

Table 1
Effect of micronutrient sprays at different concentrations on vegetative growth of Rose cv. Sophia Loren.

Tr No.	*Treatments*	*Plant height (cm)*	*Plant spread (m^2)*	*Leaf area (cm^2)*	*Shoot growth rate (cm/day)*	*Number of shoots*	*DFFBA*	*DFBO*
T_1	$MgSO_4$ 0.5%	78.54	0.263	5.72	0.274	87	34.51	28.62
T_2	$MgSO_4$ 1.0%	69.93	0.233	5.80	0.189	78	32.41	33.41
T_3	$MgSO_4$ 1.5%	70.51	0.234	5.41	0.185	59	39.08	34.54
T_4	$MnSO_4$ 0.5%	91.64	0.293	6.61	0.422	90	32.73	27.22
T_5	$MnSO_4$ 1.0%	87.83	0.269	6.73	0.467	76	24.79	28.56
T_6	$MnSO_4$ 1.5%	80.54	0.304	4.81	0.316	46	38.52	28.26
T_7	$FeSO_4$ 1.0%	85.16	0.284	6.22	0.400	71	38.16	25.32
T_8	$FeSO_4$ 1.5%	96.01	0.285	6.72	0.473	74	24.83	24.77
T_9	$FeSO_4$ 2.0%	85.33	0.318	5.21	0.386	58	27.52	28.38
T_{10}	Boric acid 0.25%	93.21	0.306	6.68	0.470	86	26.28	22.39
T_{11}	Boric acid 0.5%	97.80	0.332	5.63	0.543	67	28.35	19.76
T_{12}	Boric acid 0.75%	88.29	0.294	5.26	0.402	45	30.79	22.48
T_{13}	$ZnSO_4$ 0.5%	97.06	0.324	6.46	0.524	86	33.28	24.11
T_{14}	$ZnSO_4$ 0.75%	104.68	0.342	7.32	0.603	61	34.21	25.53
T_{15}	$ZnSO_4$ 1.0%	89.15	0.298	6.33	0.423	48	34.80	26.75
T_{16}	$CuSO_4$ 0.1%	100.61	0.354	5.89	0.627	64	35.23	25.40
T_{17}	$CuSO_4$ 0.3%	102.66	0.332	7.83	0.524	64	31.86	25.05
T_{18}	$CuSO_4$ 0.5%	79.73	0.266	5.63	0.281	46	33.30	26.49
T_{19}	Control *	83.47	0.294	4.70	0.274	47	39.03	36.27
	Mean	88.7	0.295	6.27	0.068	66	34.62	37.02
	CD	5.52	0.005	0.25	NS	2.66	0.492	1.803
	SEm	1.84	0.003	0.083	0.026	0.886	0.242	0.886

Table 2
Effect of micronutrient sprays at different concentrations on Floral parameters of Rose cv. Sophia Loren.

Tr No.	*Treatments*	*Number of flowers*	*Flower diameter (cm)*	*Flower stalk length (cm)*	*Number of petals /flowers*	*Petal size (cm^2)*	*Flower fresh weight (g)*	*Flower dry weight (g)*
T_1	$MgSO_4$ 0.5%	68.95	8.97	8.38	18.75	6.66	10.60	2.32
T_2	$MgSO_4$ 1.0%	59.73	10.39	7.68	25.45	5.99	10.12	2.12
T_3	$MgSO_4$ 1.5%	40.92	9.86	7.44	23.14	5.20	9.18	1.61
T_4	$MnSO_4$ 0.5%	71.93	10.48	10.12	22.04	6.01	9.44	3.00
T_5	$MnSO_4$ 1.0%	57.68	9.51	9.66	18.73	5.51	8.25	2.15
T_6	$MnSO_4$ 1.5%	28.25	9.63	8.48	18.22	5.32	10.97	2.06
T_7	$FeSO_4$ 1.0%	53.21	8.98	9.17	14.64	4.70	8.88	2.44
T_8	$FeSO_4$ 1.5%	56.23	10.38	10.12	21.18	4.88	9.63	2.23
T_9	$FeSO_4$ 2.0%	42.36	9.02	9.22	13.65	4.80	6.80	2.10
T_{10}	Boric acid 0.25%	70.59	9.76	10.23	16.31	5.70	10.84	2.77
T_{11}	Boric acid 0.5%	51.70	10.87	10.74	15.76	4.71	7.01	2.78
T_{12}	Boric acid 0.75%	29.64	7.83	10.15	7.64	4.49	7.67	2.45
T_{13}	$ZnSO_4$ 0.5%	70.48	9.07	10.67	14.80	5.35	10.20	1.97
T_{14}	$ZnSO_4$ 0.75%	45.48	10.33	11.56	21.58	5.68	10.56	1.77
T_{15}	$ZnSO_4$ 1.0%	32.76	8.98	10.31	16.26	6.03	8.48	1.49
T_{16}	$CuSO_4$ 0.1%	49.08	10.17	10.84	20.26	6.60	10.60	1.71
T_{17}	$CuSO_4$ 0.3%	49.95	9.15	11.99	25.95	6.16	8.08	2.31
T_{18}	$CuSO_4$ 0.5%	31.45	8.81	8.94	15.68	5.47	6.75	1.05
T_{19}	Control *	32.84	8.58	7.96	18.06	4.96	7.42	0.80
	Mean	49.64	9.51	9.66	18.32	5.42	11.5	2.32
	CD	2.756	0.655	0.32	0.828	0.544	1.602	0.310
	SEm	0.916	0.235	0.111	0.296	0.181	0.527	0.110

Table 3
Effect of micronutrient sprays at different concentrations on vase life parameters and Vase life Rose cv. Sophia Loren.

Tr No.	*Treatments*	*Water uptake (ml)*	*Transpirational loss of water (ml)*	*Electrolyte leakage (%)*	*Flower fresh weight change*	*Vase life in days*
T_1	$MgSO_4$ 0.5%	0.432	0.816	27.08	7.63	8.80
T_2	$MgSO_4$ 1.0%	0.458	0.784	30.09	9.67	8.33
T_3	$MgSO_4$ 1.5%	0.442	0.796	38.18	7.46	6.29
T_4	$MnSO_4$ 0.5%	0.433	0.826	24.59	8.47	8.44
T_5	$MnSO_4$ 1.0%	0.447	0.811	28.59	8.09	8.76
T_6	$MnSO_4$ 1.5%	0.365	0.817	42.52	8.09	8.17
T_7	$FeSO_4$ 1.0%	0.415	0.82	36.39	8.08	8.16
T_8	$FeSO_4$ 1.5%	0.414	0.79	36.91	8.57	7.55
T_9	$FeSO_4$ 2.0%	0.426	0.868	33.08	8.22	6.61
T_{10}	Boric acid 0.25%	0.43	0.778	39.31	6.48	9.31
T_{11}	Boric acid 0.5%	0.512	0.76	24.08	10.39	9.56
T_{12}	Boric acid 0.75%	0.391	0.801	35.17	6.48	9.24
T_{13}	$ZnSO_4$ 0.5%	0.464	0.855	30.62	8.11	8.28
T_{14}	$ZnSO_4$ 0.75%	0.429	0.773	24.11	10.15	9.11
T_{15}	$ZnSO_4$ 1.0%	0.454	0.857	29.79	9.16	8.14
T_{16}	$CuSO_4$ 0.1%	0.381	0.776	45.62	9.17	8.86
T_{17}	$CuSO_4$ 0.3%	0.354	0.848	41.73	9.70	7.29
T_{18}	$CuSO_4$ 0.5%	0.399	0.797	28.03	8.28	6.57
T_{19}	Control *	0.264	0.679	50.98	6.74	4.27
	Mean	0.415	0.803	29.111	6.595	8.01
	CD D	0.0041	0.0001′	1.558	0.641	
	T	0.0103	0.0004	3.395	1.369	
	DXT	0.018	0.0006	6.971	2.577	0.641
	SEm D	0.0015	0.0001	0.556	0.215	
	T	0.037	0.0004	1.215	0.457	
	DXT	0.0064	0.00o6	2.43	0.862	0.222

Vase life: Among different micronutrients Boric acid 0.5% (9.56) and CuSO4 at 0.1 per cent (107.49%) recorded highest vase life period and on par with each other. Lowest vase life was recorded in Control (4.27). Increase in vase life of flowers in Boric acid 0.5% treatment might be attributed to the role of Boron in regulation of K/Ca ration in plants (Das, 1996) which in turn helped in increased water uptake and reduced transpirational loss of water during vase life period, which ultimately resulted in prolonged vase life of the flowers. Boric acid 0.5% recorded highest flower fresh weight during vase life. Vase life of flowers is directly and positively related with Flower fresh weight (Table 3).

Increase in vase life of flowers ZnSO4 0.5% spray may be attributed to the role of Zn in improving water relations and the increased water uptake in this treatment which recorded highest water uptake compared to other treatments (0.512) (Table 3.) and electrolyte leakage recorded is in a lower range (30.62) (Table 3).

REFERENCES

Agarwal S. C. and C. P. Sharma (1978), Plant nutrients, their functions and uptake. Soil fertility, Theory and practice, ICAR, New Delhi, pp. 26-32. Arnon (1949)..

Arvind K., Shukla, B. S. Dwivedi, V. K. Singh and M. S. Gill, (2009), Macro Role of Micronutrients, *Indian J. Fert.*, Vol. 5 (5), pp. 11-12, 15-18, 21-24 & 27-30.

Bose S. K., Yadav L. P., Pal, P. Das P. and Parthasarathy 2002 Commercial flowers (Volume I) Second revised edition, Nayaprakash Publishers, New Delhi).

Chatopadhaya P. K. (1994), A text book of Pomology, Kalyani publishers, B-I/1292, Rajendranagar, Ludhiana, Punjab, India. Pp 144-181.

Das D. K. (1996), A Text book of Introductory Soil Science, General functions of plant nutrients, 295-302 (Kalyani publishers). (revised and reprinted in 2005).

Ganga M., Jagdeeswari V., K. Padma Devi and Jawaharlal, (2008), Response of chrysanthemum cv. CO1 Journal of Ornamental Horticulture, 11 (3): 220-223.

Hooda R S, Sindhu A S, Pandita M L and Kalloo (1984), Effects of Zinc and their methods of application on growth and yield of tomoto cv. HS 110. *Haryana Journal of Horticultural Science* 12: 46-47.

Jat, R. N., Khandelwal, S. K. and K. N. Gupta (2007), Effect of foliar application of Urea and Zinc sulphate on growth and flowering parameters in African marigold (Tagetes erecta Linn.)

Panse V. G. and Sukhatme P. V. (1985), Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi pp. 205-210.

Sable and Dhalke (1985), Studies on the effect of foliar feeding and soil application of nutrients on rose cv.Paradise Indian Rose Annual 4: 149-154 .

Mahesh kumar and Sen (2005), Effect of Zinc, Boron and Gibberellic acid on growth and yield of okra (Abelmoschus esculentus L. moench) The orissa journal of Horticulture vol 33 (2).

Venkatarayappa, T., Tsujita, M. J. and Hurr DP (1980), Influence of cobaltous ion (Co^{+2}) on the post harvest behaviour of 'sanonta'roses, *Journal of American society of Horticultural Science.* 105: 148-151.

Van Doorn W G., Schurer, K. and De Witte, Y. (1989), Role of endogenous bacteria in vascular blockage of cut rose flowers, *J. Plant Physiol.* 134: 371-381