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Effect of levels of fertigation and foliar spray of micronutrients on growth, flower quality and flower yield in G.I tagged *Jasminum sambac* cv. "Mysuru Mallige"

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Abstract
An experiment was conducted to known the fertigation levels along with foliar spray of micronutrients on *Jasminum sambac* cv. Mysuru Mallige in the farmer field near College of Horticulture, Mysuru during 2017-2018. The experiment was laid out in RCBD design with 9 treatments and 3 replications. The plant nourished with 100 per cent recommended dose of fertilizer along with foliar spray of micronutrients resulted in increased plant height (53.30, 60.75, 66.58, 72.70, 76.33 and 80.73 cm at 30, 60, 90, 120, 150 and 180 days after planting respectively), Highest individual leaf area and chlorophyll content of the leaf (28.50 cm^2 and 57.45 SCMR value), Maximum flowers bud diameter (3.13 cm) bud length (1.62 cm) corolla length (1.16 cm), flower diameter (4.39 cm), Highest score for freshness (4.91), fragrance (4.91), minimum loses of physiological weight (8.50 %) more shelf life of the flowers (34.10 hours) and flower yield (725.80 g/ plant) was also recorded.

Keywords: Jasmine, fertigation, micronutrients, growth, flower quality

Introduction
Jasmine is one of the traditional flower crops grown extensively in India and it belong to family Oleaceae and have more than 200 species, among them only four species are commercially cultivated in India *viz*., *Jasminum sambac, J gradiflorum, J multiflorum and J auriculatum.* The Government of India gave G.I states to cultivar Mysuru Mallige (sambac group) in 2006 for its unique fragrance and flowering characters. Mysuru Mallige is commercially cultivated in Mysore and Mandya regions of Karnataka and flowers are used for making garlands, women hair adornments, oil extraction etc., it has good demand both in domestic and international market for export due its fragrance. However the productivity this cultivar is less due to lack of technical knowledge w.r.t improved cultivation practices like nutrient and irrigation management and use of growth regulators etc., Application of required nutrients at appropriate time with proper dose plays a vital role in increasing the productivity. Fertigation which combines irrigation with fertilizer application is well recognized as the most effective and convenient means of maintaining optimum fertility level and water supply according to the specific requirements of each crop and soil. The fertilizers applied through this system reach the active root zone, thus helping easy absorption and its efficient utilization resulting in good vegetative growth and flower yield (Khan *et al*., 1997) [5]. Keeping this in mind a study was under taken to enhance the growth, flower quality and yield characters of Mysuru Mallige.

Materials and Methods
The experiment was conducted in the year 2017-18 in Farmer field, Near College of Horticulture, Mysuru, Karnataka. The soil of the experimental farm was red sandy loam with an almost uniform fertility having a pH range of 6.0-6.5. The experiment was laid out in RCBD design with 9 treatments and 3 replications. The treatments include T_1: Soil application 100% RDF (60:120:120 NPK g/plant/year) T_2:100%RDF (60: 120:120 NPK g/plant through fertigation) T_3:75% RDF (45:90:90 NPK g/plant through fertigation) T_4:50% RDF (30:60:60 NPK g/plant through fertigation) T_5: Soil application 100% RDF (60:120:120 NPK g/plant/year) + Humic acid @ 0.5% Chelated Zinc and Borax @ 0.75g each per plant.

T_6:100% RDF (60:120:120 NPK g/plant through fertigation) + Humic acid @0.5%, Chelated Zinc and Borax @ 0.75g each per plant. T_7: 75 % RDF (45:90:90 NPK g/plant through fertigation) + Humic acid @ 0.5%, Chelated Zinc and Borax @ 0.75g each per plant T_8: 50% RDF (30:60:60 NPK g/plant through fertigation) + Humic acid @ 0.5%, Chelated Zinc and Borax @ 0.75g each per plant. T_9: Farmer's practice (200g DAP, 200g MOP, 50g Urea / plant/ year). FYM @ 20kg / plant/year was applied for the plants in all treatment including farmer's practices.

The entire plot was thoroughly ploughed and brought to fine tilth after removing the weeds and stubbles prior to planting. The pits of size about 45 cm^3 were dug at a spacing of 1.5m × 1.5m and Farm yard manure (FYM) was added at the rate of 20 kg per plant. Water was pumped from the bore well through submersible pump set and it was conveyed to the main line after filtering through screen filter. From the source line, water was taken to the field through main line of 2.5" PVC pipes. Fertigation tank was installed for fertigation. From the main pipes, 2.0" PVC pipes were fixed as sub-main. From sub main, 12 mm laterals were taken and ran along with each row of plants. There was a tap control for each laterals pipe for imposing different level of fertigation treatments. Micro tubes with a discharge rate of 4.0 lph were fixed to the lateral pipes at a spacing of 1.5 m.

Four months old uniform height healthy rooted cuttings of *Jasminum sambac* cv. Mysuru Mallige were planted in the experimental site at a spacing of 1.5m X 1.5m. Light irrigation was given after transplanting for better establishment. Fertigation was given forth nightly as per the treatment details. Observations were recorded monthly on growth, flowering and yield parameters. The data collected was subjected to statistical analysis as per Panse and Sukhatme (1978).

Results and Discussion

The result obtaining with respect to growth, flower quality and flower yield of Mysuru Mallige are presented in the table 1, 2, 3 and 4 respectively.

1. Vegetative parameters

The different levels of fertigation along with foliar spray of micronutrients has significant difference among the treatments with respect to plant height at different stages of plant growth (Table.1). Plant height recorded was maximum (53.30, 60.75, 66.58, 72.70, 76.33 and 80.73 cm at 30, 60, 90, 120, 150 and 180 days after planting respectively) in fertigation treatment consisting of 100 per cent recommended dose of fertilizers along with foliar spray of Humic acid, Chelated Zinc and Borax (T_6), which was on par with T_7 (75 per cent recommended dose of fertilizers along with foliar spray of Humic acid, Chelated Zinc and Borax) (49.73, 59.17, 65.61, 70.53, 74.22 and 78.07 cm at 30, 60, 90, 120, 150 and 180 days after planting, respectively) and while, the lowest plant height was recorded in T_9 (40.33, 44.56, 46.51, 47.22, 51.10 and 56.19 cm at 30, 60, 90, 120, 150 and 180 days after planting, respectively) comprising of farmer's practice.

Highest individual leaf area and chlorophyll content of the leaf was recorded in T_6 (28.50 cm^2 and 57.45 SCMR value) treatment comprising of application of 100 per cent water soluble fertilizers through fertigation along with foliar spray of Humic acid, Chelated Zinc and Borax which was followed by T_7 consisting of 75 per cent water soluble fertilizers through fertigation along with foliar spray of Humic acid, Chelated Zinc and Borax (26.60cm^2 and 55.07 SCMR value), While lowest individual leaf area was recorded in T_9 (13.38cm^2 and 38.75 SCMR value) which refers to farmer's practice (control).

Increased height, individual leaf area and chlorophyll content in the plant which are nourished with 100 per cent recommended dose of fertilizers along with foliar spray of Humic acid, Chelated Zinc and Borax was maximum due to more available nutrient status in the root zone of the plant and thus increasing the nutrient uptake and sufficient supply of nutrients might have also shown stimulatory action in terms of cell elongation. In addition to this, micronutrients are also essential components of several enzymes like dehydrogenase, proteinase and they promote growth hormones which are closely associated with growth. All these factors contributed to cell multiplication, cell enlargement and cell differentiation resulting in increased photosynthesis, translocation of food material and the formation of metabolites required for growth and ultimately encouraged the growth of the plant. These finding are concurred with Patel *et al.* (2016) [10] in rose, Ganga *et al.* (2009) [4] in orchid.

2. Flower quality and yield parameters

Maximum flowers bud diameter (3.13 cm) bud length (1.62 cm) corolla length (1.16 cm) and flower diameter (4.39 cm) was recorded in the T_6 which refers to 100 per cent recommended dose of fertilizers with foliar spray of micronutrients like Chelated Zinc, Borax and Humic acid followed by the T_7 treatment (3.00cm, 1.42 cm, 1.10 cm and 4.22 cm respectively). The lowest flower bud diameter (1.67 cm), flower bud length (0.87 cm), corolla length (0.41 cm) and flower diameter (1.92 cm).was recorded in the treatment T_9 (control).

Highest score for freshness, fragrance, physiological loses of weight and shelf life of the flowers was recorded in T_6 treatment (4.91, 4.91, 8.50 % and 34.10 hours) which includes, application of 100 per cent water soluble fertilizers through fertigation with foliar spray of Humic acid, Chelated Zinc and Borax which was followed by T_7 (4.83, 4.82, 8.86% and 33.51 hours), While lowest score for freshness of the flowers was recorded in T_9 (3.85, 3.87, 31.50% and 24.30 hours) and increased yield of 725.80g/ plant was also recorded in the same treatment.

This may be due to the fact that the nutrient supplied increased fertigation throughout the growth period must have increased nutrient uptake, photosynthetic rate, metabolic activities, early breaking of apical dominance followed by easy and better translocation of nutrients to flowers (Shoram *et al.*, 2012). Application of micronutrients stimulate metabolic activity in terms of cell wall loosening, cell elongation and cell enlargement, it results in enlarging bud length, bud diameter, flower diameter and corolla length and chelated mix of micronutrients increases the flower diameter and also increases the flower yield.

Jasmine is most fragrant flowers than other flowers. Variation in flower fragrance, freshness, physiological loses in weight and shelf life among the different treatment might be due to application of more doses of fertilizers like NPK to the root zone of the plant might increasing the nutrient uptake, increased photosynthetic rate and metabolic activities, increases the enzymatic hydrolysis of cellular components like that of proteins into amino acids and starch in sugars. Boron helps in accumulation of simple carbohydrates and more doses of potassium in soil and plant helps to extend the shelf life of flower.

These results are in conformity with those reported by Chaturvedi *et al.* (1986) [3], in gladiolus and Koroeish (1984) [6] in chrysanthemum, Kumar *et al.* (2003) [7] in tuberose, Balakrishnan *et al.* (2007) [2] in marigold, Pawar *et al.* (2002) [9] in anthurium, Younis *et al.* (2013) [11] and Ahmad *et al.* (2010) [1] in rose

Table 1: Effect of different levels of fertigation and foliar spray of micronutrients on plant height in *Jasminum sambac* cv. Mysuru Mallige

Treatment	Plant height (cm)					
	Days after planting					
	30 days	60 days	90 days	120 days	150 days	180 days
T_1	42.00	46.40	51.35	54.73	57.43	64.87
T_2	45.70	49.37	58.08	63.05	67.86	71.53
T_3	44.00	48.13	57.52	60.90	64.90	70.37
T_4	41.23	45.77	48.50	53.10	56.77	60.83
T_5	46.03	52.07	55.03	60.07	64.55	67.07
T_6	53.30	60.75	66.58	72.70	76.33	80.43
T_7	49.73	59.17	65.61	70.53	74.22	78.07
T_8	42.07	46.87	50.25	55.50	58.20	63.03
T_9	40.33	44.56	46.51	47.22	51.10	56.19
F value	*	*	*	*	*	*
S.Em ±	2.28	2.54	1.01	0.96	0.86	0.99
CD at 5%	6.85	7.62	3.04	2.87	2.58	2.97

*Significant at 5 % level

Treatments details

T_1: Soil application 100 % RDF (60:120:120 NPK g/plant/year)
T_2: 100 % RDF (60: 120:120 NPK g/plant through fertigation)
T_3: 75 % RDF (45:90:90 NPK g/plant through fertigation)
T_4: 50 % RDF (30:60:60 NPK g/plant through fertigation)
T_5: Soil application 100% RDF (60:120:120 NPK g/plant/year) + foliar spray of Humic acid at 0.5% Chelated Zinc and Borax at 0.75g each per plant
T_6: 100 % RDF (60: 120:120 NPK g/plant through fertigation) + foliar spray of Humic acidat 0.5% Chelated Zinc and Borax at 0.75g each per plant
T_7: 75 % RDF (45:90:90 NPK g/plant through fertigation) + foliar spray of Humic acid at 0.5% Chelated Zinc and Borax at 0.75g each per plant
T_8: 50 % RDF (30:60:60 NPK g/plant through fertigation) + foliar spray of Humic acid at 0.5% Chelated Zinc and Borax at 0.75g each per plant
T_9: Farmer's Practice (200g DAP, 200g MOP, 50g Urea / plant/ year)

Note: FYM was applied at 20 kg /plant/year for all the treatments

Treatments details

T_1: Soil application 100% RDF (60:120:120 NPK g/ plant/year)
T_2: 100 % RDF (60: 120:120 NPK g/plant through fertigation)
T_3: 75% RDF (45:90:90 NPK g/plant through fertigation)
T_4: 50% RDF (30:60:60 NPK g/plant through fertigation)
T_5: Soil application 100% RDF (60:120:120 NPK g/ plant/year) + Humic acid at 0.5% Chelated Zinc and Borax at 0.75g each per plant.
T_6: 100% RDF (60:120:120 NPK g/plant through fertigation) + Humic acid at 0.5%, Chelated Zinc and Borax at 0.75g each per plant.
T_7: 75 % RDF (45:90:90 NPK g/ plant through fertigation) + Humic acid at 0.5%, Chelated Zinc and Borax at 0.75g each per plant
T_8: 50% RDF (30:60:60 NPK g/plant through fertigation) + Humic acid at 0.5%, Chelated Zinc and Borax at 0.75g each per plant.
T_9: Farmer's practice (200g DAP, 200g MOP, 5Og Urea / plant/ year)

Note: FYM was applied at 20 kg /plant/year for all the treatments

Table 2: Effect of different levels of fertigation and foliar spray of micronutrients on individual leaf area and chlorophyll content at grand growth stage

Treatment	Individual leaf area per leaf (cm^2)	Chlorophyll content (SCMR value)**
T_1	17.35	45.21
T_2	22.10	52.06
T_3	19.24	46.27
T_4	15.60	43.59
T_5	21.49	46.25
T_6	28.50	57.45
T_7	26.60	55.07
T_8	19.77	42.50
T_9	13.38	38.75
F value	*	*
S.Em ±	0.71	0.85
CD at 5%	2.14	2.56

*Significant at 5 % level ** SCMR – Spad chlorophyll meter reading

Table 3: Effect of different levels of fertigation and foliar spray of micronutrients on flower quality parameters

Treatment	Flower quality parameters			
	Bud diameter (cm)	Bud length (cm)	Corolla length (cm)	Flower diameter (cm)
T_1	2.43	1.02	0.55	3.41
T_2	2.67	1.08	0.59	3.50
T_3	2.57	0.98	0.52	3.30
T_4	1.93	0.95	0.49	3.07
T_5	2.48	1.20	0.70	3.77
T_6	3.13	1.62	1.16	4.39
T_7	3.00	1.42	1.10	4.22
T_8	2.23	1.17	0.61	3.67
T_9	1.67	0.87	0.41	1.92
F value	*	*	*	*
S.Em ±	0.10	0.02	0.03	0.07
CD at 5%	0.30	0.05	0.08	0.21

*Significant at 5 % level

Treatments details

T1: Soil application 100% RDF (60:120:120 NPK g/plant/year)
T2: 100%RDF (60: 120:120 NPK g/plant through fertigation)
T3: 75% RDF (45:90:90 NPK g/plant through fertigation)
T4: 50% RDF (30:60:60 NPK g/plant through fertigation)
T5: Soil application 100% RDF (60:120:120 NPK g/plant/year) + Humic acid at 0.5% Chelated Zinc and Borax at 0.75g each per plant.
T6: 100% RDF (60:120:120 NPK g/plant through fertigation) + Humic acid at 0.5%, Chelated Zinc and Borax at 0.75g each per plant.
T7: 75 % RDF (45:90:90 NPK g/plant through fertigation) + Humic acid at 0.5%, Chelated Zinc and Borax at 0.75g each per plant
T8: 50% RDF (30:60:60 NPK g/plant through fertigation) + Humic acid at 0.5%, Chelated Zinc and Borax at 0.75g each per plant.
T9: Farmer's practice (200g DAP, 200g MOP, 5Og Urea / plant/ year)

Note: FYM was applied at 20 kg /plant/year for all the treatments

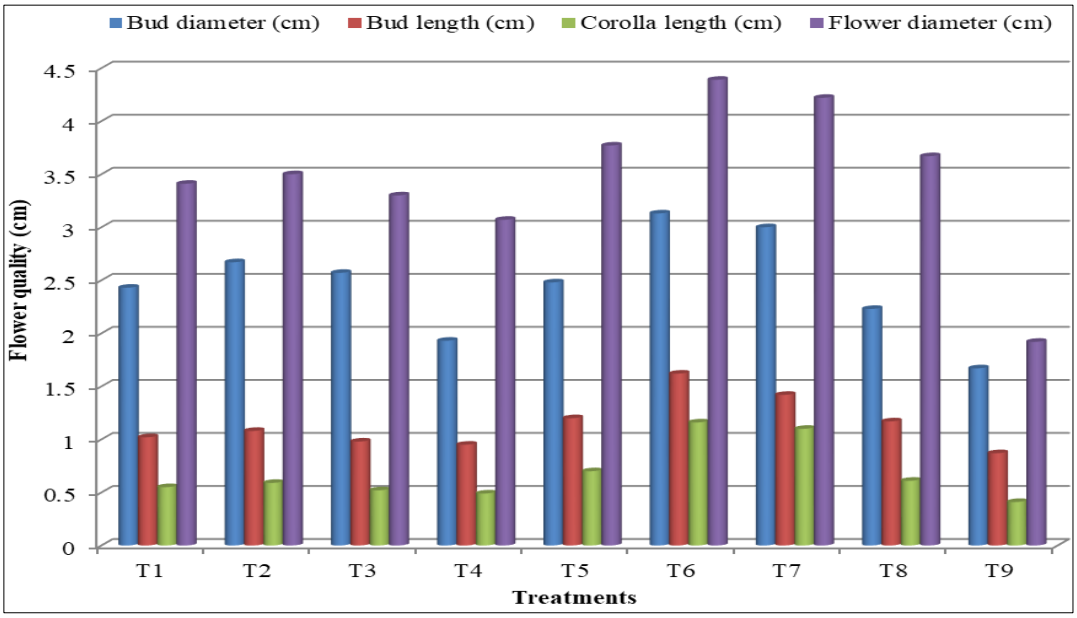

Fig 1: Effect ofdifferent levels of fertigation and foliar spray of micronutrients on flower quality parameters

Treatments details

T1: Soil application 100% RDF (60:120:120 NPK g/plant/year)
T2: 100%RDF (60: 120:120 NPK g/plant through fertigation)
T3: 75% RDF (45:90:90 NPK g/plant through fertigation)
T4: 50% RDF (30:60:60 NPK g/plant through fertigation)
T5: Soil application 100% RDF (60:120:120 NPK g/plant/year) + Humic acid at 0.5% Chelated Zinc and Borax at 0.75g each per plant.
T6: 100% RDF (60:120:120 NPK g/plant through fertigation) + Humic acid at 0.5%, Chelated Zinc and Borax at 0.75g each per plant.
T7: 75 % RDF (45:90:90 NPK g/plant through fertigation) + Humic acid at 0.5%, Chelated Zinc and Borax at 0.75g each per plant
T8: 50% RDF (30:60:60 NPK g/plant through fertigation) + Humic acid at 0.5%, Chelated Zinc and Borax at 0.75g each per plant.
T9: Farmer's practice (200g DAP, 200g MOP, 5Og Urea / plant/ year)

Table 4: Effect of different levels of fertigation and foliar spray of micronutrients on flower quality parameters

Treatment	Flower quality parameters.				
	Freshness index (5 point scale)	Fragrance index (5 point scale)	PLW (%) (upto24 hours)	Shelf life (hrs)	Yield per plant (cumulative) (g)
T_1	3.90	3.98	18.20	26.13	518.67
T_2	4.27	4.23	13.25	29.33	615.73
T_3	4.13	4.10	16.50	28.38	556.09
T_4	4.33	4.25	21.50	26.35	506.33
T_5	4.42	4.33	15.20	27.37	566.50
T_6	4.91	4.91	8.50	34.10	725.80
T_7	4.83	4.82	8.86	33.51	640.50
T_8	4.30	4.30	16.65	31.20	508.00
T_9	3.85	3.87	31.50	24.30	458.33
F value	*	*	*	*	*
S.Em ±	0.09	0.09	0.25	0.07	2.98
CD at 5%	0.28	0.26	0.74	0.21	8.94

*Significant at 5 % level

Treatments details

- **T_1:** Soil application 100% RDF (60:120:120 NPK g /plant/year)
- **T_2:** 100%RDF (60: 120:120 NPK g/plant through fertigation)
- **T_3:** 75% RDF (45:90:90 NPK g/plant through fertigation)
- **T_4:** 50% RDF (30:60:60 NPK g/plant through fertigation)
- **T_5:** Soil application 100% RDF (60:120:120 NPK g/ plant/ year) + Humic acid at 0.5% Chelated Zinc and Borax at 0.75g each per plant.
- **T_6:** 100% RDF (60:120:120 NPK g/plant through fertigation) + Humic acid at 0.5%, Chelated Zinc and Borax at 0.75g each per plant.
- **T_7:** 75 % RDF (45:90:90 NPK g/plant through fertigation) + Humic acid at 0.5%, Chelated Zinc and Borax at 0.75g each per plant
- **T_8:** 50% RDF (30:60:60 NPK g/plant through fertigation) + Humic acid at 0.5%, Chelated Zinc and Borax at 0.75g each per plant.
- **T_9:** Farmer's practice (200g DAP, 200g MOP, 5Og Urea / plant/ year)

Note: FYM was applied at 20 kg /plant/year for all the treatments

References

1. Ahmad I, Khan AM, Qasim M, Ahmad R, Randhawa AM. Growth, yield and quality of *Rosa hybrida* L. as influenced by various micronutrients. Pakistan J. Agric. Sci. 2010; 47(1):5-12.
2. Balakrishnan V, Jawaharlal M, Kumar TS, Ganga M. Response of micro nutrients on flowering, yield and xanthophyll content in African marigold (*Tagetes erecta* L.). J Orn. Hort. 2007; 10(3):153-156.
3. Chaturvedi OP, Shukla IN, Singh AR. Effect of agromin in growth and flowering in gladiolus. Prog. Hort. 1986; 18(3-4):196-199.
4. Ganga M, Padmadevi K, Jegadeehwari V, Jawaharlal M. Performance of *Dendrobium* cv. Sonia 17 as influenced by micronutrients. J Orn. Hort. 2009; 12(1):39-43.
5. Khan MM, Shyamalamma S, Krishna manohar R. Relevance of greenhouse technology in India. In: Progressive floriculture. The house of Sarpan, Banglore, 1997, 1-6.
6. Koroeish EM. Foliar application of some commercial fertilizer on *Chrysanthemum morifolium* Ramat, Ann. Agric. Sci. 1984; 21(31):977-985.
7. Kumar HK, Singh SS, Ahlawat VP, Yadav BS. Influence of nitrogen and zinc application on growth, flowering and chlorophyll content of tuberose (*Polianthus tuberosa* L.) cv. Double. Haryana J. Hort. Sci. 2003; 32(3-4):212- 215.
8. Panse VS, Sukhatamane PV. Stat. methods for Agric. workers, ICAR, New Delhi, 1967, 152-155.
9. Pawar GM, Patil MT, Gaikwad AM. Effect of different substrates on *Anthurium reanum*. In: National Sym. on Indian Flori. in the New Millennium (Feb. 25-27, 2002) IARI, New Delhi, 2002, 50-52.
10. Patel H, Bhatt D, Patel GD, Chawla SL, Gurjar T. Effect of foliar application of micronutrients on growth and flowering of Rose cv. Top Secret under poly house condition. Intl. J Life. Sci. 2016; 11(1):603-606.
11. Youniss A, Riaz A, Sajid M, Mushtaq N, Ashan M, Hameed M *et al*. Foliar application of macro and micronutrients on the yield and quality of Rosa hybrid cvs. Cardinal and Whisky Mac. African J Biotech. 2013; 12(7):702-708.