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Effect of foliar application of biostimulants and micronutrients on growth and flowering of African marigold cv. Pusa Narangi Gainda

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Abstract
The present experiment entitled "Effect of foliar application of biostimulants and micronutrients on growth, flowering and yield of African marigold cv. Pusa Narangi Gainda" was carried out at Jamuvadi Farm, Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh, during 2017 to 2019. The experiment was laid out in Randomized Block Design with Factorial concept (FRBD) consisting two factors with three replications. The treatment comprised with four biostimulants and three treatment of micronutrients. The result indicated that the foliar application of banana pseudostem sap @ 1% 60, 90 DAT and at final harvest with micronutrients grade-IV @ 1% in addition to recommended does of fertilizers (200:100:100 kg/ha NPK) produced better growth characters *viz*., the plant height, plant spread (E-W and N-S), number of branches per plant, fresh weight of plant, dry weight of plant as well as flowering characters *viz*., days to initiation of flowering, days to 50% flowering, flowering duration (days), flower stalk length in African marigold cv. Pusa Narangi Gainda.

Keywords: Biostimulants, micronutrients, African marigold cv. Pusa Narangi Gainda

Introduction
African marigold (*Tagetes erecta* L.) is one of the important commercial flower of India as well as Gujarat and being grown for its spectacular flowers, brilliant colours, delightful appearance, size, shape, forms etc. It belongs to the family Asteraceae (2n=24) and originated from Central to Southern America especially Mexico, from there it reached to Spain and became popular by the name of 'Rose of Indies'.

At present, for the increasing flower production, nutrient are supplied through chemical fertilizers. Biostimulants are products of natural and organic origin that stimulates plants to achieve their higher growth and yield potential. Seaweed extracts contain major and micro nutrients, amino acids, vitamins, cytokinins, auxin and abscisic acid like growth promoting substances. The liquid contained macronutrients like P 120 mg/100g, K 4170 mg/100g, Ca 66.98 mg/100g and micronutrients like Fe 147 mg/100g, Mn 5.84 mg/100g, Zn 9.08 mg/100g and Cu 0.36 mg/100g (Yan *et al.*, 2013) [20]. Panchagavya is a fermented product made from five ingredients obtained from cow, such as milk, urine, dung, curd and clarified butter (Amalraj *et al*., 2013) [3]. Panchgavya contained macro element like total nitrogen (229 ppm), total phosphorous (209 ppm), total potassium (232 ppm), calcium (25 ppm), IAA (8.5 ppm) and GA (3.5 ppm) (Anon., 2017).While separating fibers from the banana pseudostem, the liquid available is known as sap which contains good amount of essential macro element like 119 ppm N, 50.4 ppm P, 1289 ppm K and micronutrients like Fe-124 ppm, Mn-6.73 ppm, Cu-4.61 ppm and Zn-0.97 ppm (Gundrashiya, 2013) [11] and also growth promoting substance like, cytokinin- 137.8 mg/l and gibberellic acid- 110.2 mg/l present (Desai, 2018) [9, 13].

Micronutrients are needed in very small amounts. Their concentration in plants are generally below the 100 parts per million (ppm) level. Out of 17 essential elements, Fe, Zn, B, Cu, Mn, Mo although required in very little amount but their importance for the plant is no way less than those of major elements. Due to, deficiency of these minor elements the leaves, branches and flower may not grow properly and they may even affect the flower quality as well as production. These elements also help in development of hormone, enzyme, chlorophyll and in the absorption of the major elements. The need of micronutrients in flower production has long been recognized in India. It is important to keep the need for micronutrient fertilizers in perspective. Application of micronutrients in the hope of increasing crop yields even through

there is little evidence to suggest a deficiency exists. The concern about micronutrient deficiencies are encouraged to investigate the need thoroughly and apply the nutrients in test strips if necessary. Considering the above facts, the present study was planned and undertaken with the objective to assess the response of biostimulants and micronutrients on growth and flowering of African marigold cv. Pusa Narangi Gainda.

Materials and methods

The field experiment was carried out twice during October 2017 to February 2019 at the Jambuvadi Farm, Department of Horticulture, Junagadh Agricultural University, Junagadh (Gujarat). The experiment was laid out in Randomized Block Design with Factorial concept (FRBD) consisting two factors with three replications. The treatment comprised with four biostimulants *viz*., without spray of biostimulants (B_0), Seaweed extract @ 1% (B_1), Panchgavya @ 3% (B_2) and Banana pseudostem sap @ 1% (B_3) and three treatments of micronutrients *i.e*. without micronutrients (F_0), micronutrients grade-IV @ 0.5% (F_1) and micronutrients grade-IV @ 1% (F_2). Five plants from each treatment plot were randomly selected, labeled and used for recording observation. For the growth characters, the plant height, plant spread (E-W and N-S), number of branches per plant, fresh weight of plant and dry weight of plant 60, 90 DAT and at final harvest were recorded from each treatment plot. To assess performance of biostimulants and micronutirents on flowering behavior and flowering charactes, the observation were recorded on days to initiation of flowering, days to 50% flowering, flowering duration (days), flower stalk length in African marigold cv. Pusa Narangi Gainda.

Table 1: Time of applications

Time of application of biostimulants (both seasons)	Time of application of micronutrinets (both seasons)
1st 30 days after transplanting	1st 40 days after transplanting
2nd 45 days after transplanting	2nd 55 days after transplanting
3rd 60 days after transplanting	3rd 70 days after transplanting

Result and discussion

Table 2, 2(a) & (b): Effect of biostimulants on growth parameters

Significantly maximum plant height (44.86, 61.06 and 66.35 cm), respectively at 60, 90 DAT and at final harvest in pooled, plant spread E-W (20.90, 23.38 & 22.14 cm, respectively) at 60 DAT and (33.77, 40.27 cm, respectively) at 90 DAT and at final harvest stage in pooled, plant spread N-S (25.55 & 46.37 cm, respectively) at 60 DAT and at final harvest in pooled, number of branches per plant (11.09, 11.93 & 11.51, respectively) at 60 DAT and (16.26 & 20.60, respectively) at 90 DAT and at final harvest, fresh weight of plant (166.39 & 167.42 g, respectively) at 60 DAT during the year 2017-18 and in pooled, (206.17, 209.48 & 207.82 g, respectively) at 90 DAT, (252.43, 256.13 & 254.28 g, respectively) at final harvest, dry weight of plant (43.50, 45 & 44.25 g, respectively) at 60 DAT, (49.45 & 50.37 g) at 90 DAT during the year 2017-18 and in pooled and (54.2 g, respectively) at final harvest were registered with an foliar application of banana pseudostem sap @ 1% (B_3) in pooled. Banana pseudostem sap contain some biochemical such as gibberellic acid, NAA, cytokinin and chemicals i.e. N, P, K, Ca, Mg, S, micronutrients (Mn, Cu, Zn) and beneficial microbes (PSB, rhizobium, azotobacter and fungus). The most pronounced effect of gibberellins is on plant spread and vigorous growth of marigold. Also it might be due to increasing auxin level of tissue or enhance the conversion of tryptophan to IAA leading to the enhanced activity of cell division and cell elongation through the effect of gibberellic acid and cytokinin singly or due to combine effect of both. The results of present study are in close conformity with findings of Jadhav *et al*. (2014) [12] and Patel *et al*. (2018) [13] in marigold; Desai (2018) [9, 13] in tuberose and Gundrashiya (2013) [11] in okra, cluster bean and cow pea.

Table 2, 2(a) & (b): Effect of micronutrients on growth parameters

Significantly maximum number of branches per plant (10.60) at 60 DAT during pooled, dry weight of plant (41.91 g) at 60 DAT were registered with foliar application of micronutrient grade IV @ 1% (F_2) during pooled. Increase in plant growth due to iron that acts as an important catalyst in the enzymatic reactions of the metabolism and would have helped in larger biosynthesis of photo assimilates thereby enhancing growth of the plants. These are component of many enzymes associated with energy transfer, nitrogen reduction and fixation, and lignin formation. Iron is associated with sulfur in plants to form compounds that catalyze other reactions.

Micronutrients are involved in all metabolic and cellular functions. Improvement in growth characters due to micronutrient application might basically be due to enhanced photosynthetic and other metabolic activities related to cell division and elongation. Iron application increased the levels of all leaf pigments, but the extent of increase in level depend on the pigment affected **(**Srivastava, 2003) [18].

Similarly Aruna *et al.* (2007) [5] reported that foliar spray of $ZnSO_4$ and $FeSO_4$ formulation increased leaf characters in crossandra. The superiority of micronutrient formulations on chlorophyll content also interpreted by Balakrishnan *et al.* (2007) [6] in African marigold, Ahmad *et al.* (2010) [1] in rose.

Table 2: Effect of biostimulants and micronutrients on growth parameters in African marigold cv. Pusa Narangi Gainda

Treatments	Plant height at 60 DAT (cm)			Plant height at 90 DAT (cm)			Plant height at final harvest (cm)			Plant spread E-W at 60 DAT (cm)			Plant spread E-W at 90 DAT (cm)		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Level of Biostimulants (B)															
B_0	35.52	43.03	39.28	53.27	56.70	54.98	54.31	62.44	58.38	16.22	18.58	17.40	27.07	31.56	29.32
B_1	38.19	44.08	41.14	53.81	56.89	55.35	55.63	63.01	59.32	17.46	20.52	18.99	27.54	33.23	30.38
B_2	39.06	46.09	42.57	55.39	59.51	57.45	58.13	65.86	61.99	19.00	22.28	20.64	29.52	34.62	32.07
B_3	42.41	47.32	44.86	60.12	62.01	61.06	64.43	68.28	66.35	20.90	23.38	22.14	31.56	35.97	33.77
S.Em.±	1.67	1.17	1.02	1.83	1.53	1.19	2.58	1.87	1.59	0.68	0.82	0.53	1.24	1.12	0.84

C.D. at 5%	NS	NS	2.92	NS	NS	3.40	NS	NS	4.54	2.01	2.40	1.52	NS	NS	2.38
Level of Micronutrients (F)															
F_0	37.99	44.43	41.21	55.03	58.21	56.62	57.45	64.39	60.92	17.71	20.51	19.11	28.40	33.38	30.89
F_1	39.01	44.89	41.95	56.32	58.80	57.56	58.48	64.55	61.51	18.48	21.27	19.88	29.02	33.89	31.45
F_2	39.39	46.06	42.73	55.60	59.32	57.46	58.44	65.76	62.10	19.00	21.79	20.39	29.36	34.27	31.81
S.Em.±	1.45	1.02	0.89	1.59	1.32	1.03	2.23	1.62	1.38	0.59	0.71	0.46	1.07	0.97	0.72
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interaction (B X F)															
S.Em.±	2.90	2.03	1.77	3.17	2.64	2.07	4.46	3.24	2.76	1.19	1.42	0.92	2.15	1.94	1.45
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	12.95	7.79	10.33	9.88	7.79	8.84	13.29	8.64	10.98	11.16	11.57	11.42	12.87	9.93	11.3

Table 2(a): Effect of biostimulants and micronutrients on growth parameters in African marigold cv. Pusa Narangi Gainda

Treatments	Plant spread N-S at final harvest (cm)			Number of branches at 60 DAT			Number of branches at 90 DAT			Number of branches at final harvest			Fresh weight at 60 DAT (g/plant)		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Level of Biostimulants (B)															
B_0	39.70	41.03	40.37	8.42	9.98	9.20	13.07	14.89	13.98	16.84	20.84	18.84	147.40	151.78	149.59
B_1	41.12	43.00	42.06	9.07	10.33	9.70	13.93	15.00	14.47	17.29	21.40	19.34	152.22	155.27	153.74
B_2	44.14	44.94	44.54	10.49	10.89	10.69	14.51	15.64	15.08	17.82	21.91	19.87	162.13	163.17	162.65
B_3	45.45	47.30	46.37	11.09	11.93	11.51	15.36	17.16	16.26	18.36	22.84	20.60	166.39	168.46	167.42
S.Em.±	1.55	1.58	1.11	0.29	0.34	0.22	0.56	0.61	0.42	0.39	0.50	0.32	4.78	4.44	3.26
C.D. at 5%	NS	NS	3.15	0.85	1.00	0.64	NS	NS	1.18	NS	NS	0.90	14.01	NS	9.29
Level of Micronutrients (F)															
F_0	41.67	43.31	42.49	9.40	10.25	9.83	13.87	14.92	14.39	17.38	21.30	19.34	155.17	158.05	156.61
F_1	42.59	44.08	43.34	9.82	10.98	10.40	14.42	15.93	15.18	17.65	21.88	19.77	156.43	159.76	158.10
F_2	43.56	44.81	44.18	10.08	11.12	10.60	14.37	16.17	15.27	17.70	22.07	19.88	159.50	161.20	160.35
S.Em.±	1.34	1.37	0.96	0.25	0.30	0.19	0.49	0.53	0.36	0.33	0.43	0.27	4.14	3.84	2.82
C.D. at 5%	NS	NS	NS	NS	NS	0.55	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interaction (B X F)															
S.Em.±	2.68	2.73	1.91	0.50	0.59	0.39	0.97	1.06	0.72	0.67	0.87	0.55	8.27	7.68	5.64
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	10.91	10.74	10.82	8.91	9.5	9.25	11.86	11.69	11.78	6.57	6.92	6.83	9.13	8.33	8.73

Table 2(b): Effect of biostimulants and micronutrients on growth parameters in African marigold cv. Pusa Narangi Gainda

Treatments	Fresh weight at 90 DAT (g/plant)			Fresh weight at final harvest (g/plant)			Dry weight at 60 DAT (g/plant)			Dry weight at 90 DAT (g/plant)			Dry weight at final harvest (g/plant)		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Level of Biostimulants (B)															
B_0	186.16	189.70	187.93	219.19	222.96	221.07	36.38	39.50	37.94	43.20	45.61	44.40	46.95	49.71	48.33
B_1	190.92	192.90	191.91	226.02	228.09	227.05	36.55	40.92	38.74	44.36	47.55	45.96	47.36	51.18	49.27
B_2	201.25	205.84	203.55	244.36	246.31	245.33	39.20	43.30	41.25	46.55	49.17	47.86	48.81	52.23	50.52
B_3	206.17	209.48	207.82	252.43	256.13	254.28	43.50	45.00	44.25	49.45	51.29	50.37	53.70	54.73	54.21
S.Em.±	5.26	5.48	3.80	8.74	8.60	6.13	0.96	1.07	0.72	1.37	1.39	0.98	1.81	1.62	1.21
C.D. at 5%	15.42	16.08	10.83	25.62	25.24	17.49	2.80	3.14	2.05	4.02	NS	2.78	NS	NS	3.46
Level of Micronutrients (F)															
F_0	194.63	198.25	196.44	234.23	237.22	235.72	37.70	40.89	39.29	45.05	47.47	46.26	47.82	51.36	49.59
F_1	195.89	199.72	197.80	235.35	238.38	236.87	38.97	41.90	40.43	45.89	48.13	47.01	49.37	51.88	50.63
F_2	197.86	200.47	199.17	236.91	239.52	238.22	40.06	43.75	41.91	46.73	49.61	48.17	50.42	52.64	51.53
S.Em.±	4.55	4.75	3.29	7.57	7.45	5.31	0.83	0.93	0.62	1.19	1.20	0.84	1.57	1.40	1.05
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	1.77	NS	NS	NS	NS	NS	NS
Interaction (B X F)															
S.Em.±	9.11	9.50	6.58	15.13	14.90	10.62	1.66	1.86	1.24	2.37	2.41	1.69	3.14	2.80	2.10
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	8.04	8.24	8.15	11.13	10.83	10.98	7.37	7.62	7.51	8.95	8.62	8.78	11.04	9.33	10.18

Table 3: Effect of biostimulants on flowering

Significantly minimum days required for emergence of first flowering (41.13, 44.73 and 42.93 days) during the year 2017-18, 2018-19 and in pooled, minimum days required for 50% flowering (51.07, and 54.38 days) during the year 2017-18 and in pooled, maximum flowering duration (56.72 days) and maximum flower stalk length (6.27, 7.79 and 7.03 cm) were registered with foliar application of banana pseudostem sap 1% (B_3) during the year 2017-18, 2018-19 and in pooled, respectively. It can be inferred that the spraying of enriched liquid like sap enhanced the metabolic activities of plants and thus control the vegetative phase of the plant will helpful in converting plant vegetative phase to reproductive phase and increase the flowering duration of marigold. Furthermore, these findings are well supported by Jadhav *et al*. (2014) [12] and Patel *et al*. (2018) [13] in marigold; Desai (2018) [9, 13] in tuberose and Gundrashiya (2013) [11] Gundrashiya in okra, cluster bean and cow pea. This might be due to the easy uptake of nutrients and simultaneous transport of growth promoting substances like cytokinins to the axiallary buds

resulting in breakage of apical dominance and also this may be due to the partitioning efficiency *viz*., increased allocation of photosynthates towards the economic part and also hormonal balance in the plant system. Ultimately, they resulted in better sink for faster mobilization of photosynthates and early transformation of plant parts from vegetative to reproductive phase. These results are in the line with the findings in gerbera by Selviraj *et al*. (2003) in marigold. Also it might be due to the increased availability and uptake of nutrients, water and also increased activity of GA, IAA and cytokinins. Auxins and GA promote flowering and cytokinins delay senescence and also promoted the movement of nutrients in the plant, which increases the period of flowering. These results are in the line with the findings by Vetrivel *et al*. (2017) [19] in chrysanthemum; Bellubbi *et al*. (2015) [7] in gerbera; Singh *et al*. (2007) [17] in tuberose; Bhalla *et al*. (2006b) [8] in gladiolus; and Sharma *et al*. (2011) [15] in carnation.

Table 3: Effect of micronutrients on flowering

Significantly maximum flower stalk length (5.12, 7.11 and 6.11 cm) were recorded with foliar application of micronutrient grade-IV 1% (F_2) during the year 2017-18, 2018-19 and in pooled, respectively. Zinc is effective in plant nutrition for the synthesis of plant hormones and balancing intake of P and K inside the plant cells. Zinc also increases the green pigments of necrotic leaf of plants **(**Srivastava, 2003) [18]. Copper is essential for photosynthesis and mitochondrial respiration, for carbon and nitrogen metabolism, for oxidative stress protection, and is required for cell wall synthesis (Ganesh and Kannan, 2013) [10]. The primary role of Boron in plants is to improve Calcium metabolism and improved solubility and mobility of Calcium and helps the absorption of Nitrogen. It involves in metabolism and transport of carbohydrates, regulation of meristematic tissue cell synthesis, lignifications, growth regulatory metabolism, phenol metabolism and integrity of membranes, root elongation, DNA synthesis, pollen formation and pollination (Shukla *et al.* 2009) [16]. Ganesh *et al.* (2013) [10] in a field experiment on tuberose also observed that foliar spray of all the micronutrients (B, Zn and Fe) improved flower length.

Table 3: Effect of biostimulants and micronutrients on flowering parameters in African marigold cv. Pusa Narangi Gainda

Treatments	Days to initiation of flowering (days)			Days to 50% flowering (days)			Flowering duration (days)			Flower stalk length (cm)		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Level of Biostimulants (B)												
B_0	50.60	54.13	52.37	60.60	62.27	61.43	48.58	55.84	52.21	3.66	5.42	4.54
B_1	49.31	51.04	50.18	59.00	60.33	59.67	49.55	56.69	53.12	4.05	6.27	5.16
B_2	47.02	48.24	47.63	56.96	57.22	57.09	51.32	59.07	55.19	4.80	7.17	5.98
B_3	41.13	44.73	42.93	1.07	57.69	54.38	52.56	60.87	56.72	6.27	7.79	7.03
S.Em.±	1.20	1.36	0.91	1.56	1.54	1.10	1.14	1.36	0.89	0.17	0.26	0.15
C.D. at 5%	3.52	3.98	2.58	4.57	NS	3.13	NS	NS	2.54	0.50	0.75	0.44
Level of Micronutrients (F)												
F_0	47.38	49.97	48.68	57.38	60.40	58.89	49.96	56.92	53.44	4.49	6.29	5.39
F_1	47.13	49.45	48.29	57.13	59.17	58.15	50.88	58.27	54.57	4.48	6.58	5.53
F_2	46.53	49.20	47.87	56.20	58.57	57.38	50.67	59.17	54.92	5.12	7.11	6.11
S.Em.±	1.04	1.17	0.78	1.35	1.34	0.95	0.99	1.18	0.77	0.15	0.22	0.13
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.43	0.65	0.38
Interaction (B X F)												
S.Em.±	2.08	2.35	1.57	2.70	2.67	1.90	1.97	2.36	1.54	0.29	0.44	0.27
C.D. at 5 %	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	7.66	8.21	7.96	8.22	7.8	8.01	6.77	7.04	6.94	10.82	11.55	11.48

Summary and conclusion

On the basis of result obtained in the present investigation it may be concluded that the foliar application of banana pseudostem sap @ 1% at 30, 45 & 60 days after transplanting with micronutrient grade-IV @ 1% at 40, 55 & 70 days after transplanting in addition to recommended dose of fertilizers (200:100:100 kg/ha NPK) proved to be the best treatment for getting higher vegetative growth and flowering in African marigold cv. Pusa Narangi Gainda.

References

1. Ahmad I, Khan AM, Qasim M, Ahmad R, Randhawa MA. Growth, yield and quality of *Rosa hybrid* L. as influenced by various micronutrients. Pak. J Agri. Sci. 2010; 47(1):5-12.
2. Almas. Effect of different levels of pruning and micronutrients on growth, flowering and cut flower yield of Dutch rose cv. First Red under greenhouse condition. M. Sc. (Horti.) Thesis, J.A.U., Junagadh, Gujarat, 2012.
3. Amalraj ELD, Praveen KG, Ahmed SKMH, Abdul R, Kishore N. Microbiological analysis of panchagavya, vermicompost, and FYM and their effect on plant growth promotion of pigeon pea (*Cajanus cajan* L.) in Indian. Organic Agriculture. 2013; 3:23-29.
4. Anonymous. The Indian Horticulture Database 2016-17. National Horticulture Board, Gurgaon. Available at http://nhb.gov.in/area-pro/(3rd Estimate).pdf accessed on 5 May, 2017.
5. Aruna P, Rajangam P, Geetha R, Manivanan MI. Nutrient studies in crossandra. The Asian. J Hort. 2007; 2(2):169-177.
6. Balakrishnan V, Jawaharlal M, Senthil Kumar T, Ganga M. Response of micronutrients on flowering and yield in African marigold. J Ornam. Hort. 2007; 10(3):153-156.
7. Bellubbi SB, Kulkarni BS, Patil CP. Effect of integrated nutrient management on growth and flowering of gerbera (*Gerbera jamesonii* L.) var. Rosalin under naturally ventilated polyhouse condition. Int. Agril. Sci. Veteri. Medicine. 2015; 1(1):69-74.
8. Bhalla R, Dharma S, Dhiman SR, Jain R. Effect of biofertilizers and biostimulants on growth and flowering

in standard carnation (*Dianthus Caryophyllus* L.). J Ornam. Hort. 2006; 9(4):282-285.
9. Desai SA. Effect of plant growth enhancers on growth, flowering and yield of tuberose cv. Prajwal. M. Sc. Thesis, Navsari agricultural University, Navsari (Gujarat, India), 2018.
10. Ganesh S, Kanan M. Essentiality of micronutrients in flower crops: A review. J Agric. Alli Sci. 2013; 2(3):52-57.
11. Gundrashiya RR. Effect of spraying of banana pseudostem based enriched sap at different concentration on growth and yield of different crops. M. Sc. Thesis, Navsari agricultural University, Navsari (Gujarat, India), 2013.
12. Jadhav PB, Singh A, Mangave BD, Patil NB, Patel DJ, Dekhanr SS, Kireeti A. Effect of organic and inorganic fertilizers on growth and yield of African marigold (*Tagetes erecta* L.) cv. Pusa Basanti Gainda. Ann. Bio. Res. 2014; 5(9):10-14.
13. Patel VD, Patel GD, Desai KD, Patel DJ, Mangave BD. Effect of Integrated nutrient management on growth and flower yield of African Marigold. Int. J Pure App. Biosci. 2018; 6(1):568-572.
14. Selvaraj N. Report on the Work Done on Organic Farming at Horticulture Research Station. Tamil Nadu Agricultural University, Ooty, India, 2003, 2-5.
15. Sharma BP, Gautam A, Gupta YC, Dhiman SR, Bhalla R. Effect of foliar sprays of biostimulants on growth and flowering of carnation cv. Sunrise. J Ornam. Hort. 2011; 13(2):101-106.
16. Shukla AK, Dwivedi BS, Singh VK, Gill MS. Macro role of micronutrients. Indian J Fert. 2009; 5(5):11-30.
17. Singh B, Srivastava R, Chandra R. Response of panchgavya and manchurian mushroom tea on floral characters in tuberose (*Polianthes tuberose* L.) cv. Pearl Double. J Ornam. Hort., 2007; 10(4):250-254.
18. Srivastava AK. Citrus Nutrition. International books distributing Co., Lucknow, 2003, 11-17.
19. Vetrivel T, Jawaharlal M, Arulmozhiyan R, Kannan M. Effect of bio-stimulants on growth and yield of chrysanthemum (*Dendranthema grandiflora* Tzvelev.) var. Amalfi under protected cultivation. Eco. Environ. Conservat. 2017; 23(4):2297-2301.
20. Yan P, Enyi X, Kai Z, Mangaladoss F, Xianwen Y, Xuefeng Z *et al*. Nutritional and chemical composition and antiviral activity of cultivated seaweed Sargassumnaozhouense Tseng et Lu. Mar Drugs. 2013; 11(1):20-32.