International Journal of Research in Agronomy 2024; SP-7(1): 125-129

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
www.agronomyjournals.com
2024; SP-7(1): 125-129
Received: 17-10-2023
Accepted: 22-11-2023

Srinivasulu GB
Department of Floriculture and Landscape Architecture, University of Horticultural Sciences, Bagalkot, Karnataka, India

Mukund Shiragur
Department of Floriculture and Landscape Architecture, University of Horticultural Sciences, Bagalkot, Karnataka, India

Raghavendra Achari
Department of Plant Pathology, University of Horticultural Sciences, Bagalkot, Karnataka, India

CG Yadav
Department of Agricultural Economics, University of Horticultural Sciences, Bagalkot, Karnataka, India

Chandan K
Department of Post-harvest Technology, University of Horticultural Sciences, Bagalkot, Karnataka, India

Manukumar HR
Department of Fruit Science, University of Horticultural Sciences, Bagalkot, Karnataka, India

Corresponding Author:
Srinivasulu GB
Department of Floriculture and Landscape Architecture, University of Horticultural Sciences, Bagalkot, Karnataka, India

Effect of integrated nutrient management on growth and yield of Crossandra [*Crossandra infundibuliformis* (L.) Nees.] under the northern dry zone of Karnataka

Srinivasulu GB, Mukund Shiragur, Raghavendra Achari, CG Yadav, Chandan K and Manukumar HR

DOI: https://doi.org/10.33545/2618060X.2024.v7.i1Sb.268

Abstract
Studies were carried out to investigate the effect of integrated nutrient management on the growth and yield of Crossandra [*Crossandra infundibuliformis* (L.) Nees.] at the Department of Floriculture and Landscape Horticulture, College of Horticulture Munirabad, Koppal. Results recorded 120 days after imposition of the treatments, *i.e.* application of 125% RDF + Biofertilizers, had significantly improved the growth, flowering and yield attributes. There was a significant increase in plant height (42.73 cm), number of primary (9.33) and secondary (29.73) branches, and plant spread in NS (47.86) and EW (59.75) direction. It was on par with treatment including 100% RDF + Biofertilizers [plant height 40.36 cm, number of branches primary (7.96) secondary (25.87) and plant spread (cm) NS (45.14), EW (50.61), respectively]. Similarly, concerning flower and yield traits, the first spike initiation occurred as early as 87.67 days, days to 50 percent flowering (99.13 days), days taken to first harvest (91.25 days), duration of flowering (29.45 days), number of flowers per spike (28.35), number of spikes per plant (120.25), spike length (8.21 cm), the weight of 100 flowers (6.85 g), flower yield per plant (140.68 g), flower yield per plot (2.38 kg) and flower yield per hectare (3303.44 kg) recorded were found to be significantly higher. In contrast, flowering parameters were on par with 100% RDF + Biofertilizers and yield parameters were on par with 125% RDF + humic acid @ 0.5%.

Keywords: Integrated nutrient management, growth, yield, *Crossandra infundibuliformis* (L.) Nees.

1. Introduction

Crossandra [*Crossandra infundibuliformis* (L.) *Nees.*] is an important commercial traditional flower crop belonging to the family Acanthaceae. It is a small evergreen shrub that is quite hardy. It is believed to be native to South India and Sri Lanka and is mainly grown as an important loose flower crop. Crossandra is an important traditional flower crop in south India. In south India, the flowers are widely used in temples to offer deities and make *gajras*, and *venis* are used to adorn the hair. The area under commercial cultivation of this crop is gradually increasing trend and presently reaching the extent of 4,700 ha in Karnataka, Tamil Nadu and Andhra Pradesh (Anon., 2016) [2]. In Karnataka, Crossandra is a major flower crop in the Koppal district, with an area of 223 ha and placed next to Chikkaballapura (229 ha). It is an economically important flower crop in the country, particularly in the southern region. This flower is also a valuable ornamental pot in Sweden, Denmark and Hungary. The word "*Crossandra*" is derived from the Greek word "*krossi*", which means "fringe", and "*Aner*" means; "male", *i.e.*, fringed anthers (Ashwath *et al.*, 2007) [3]. In South India, it is popularly known as '*Kanakaambaram',* meaning golden fabric in Tamil, Malayalam and Telugu because of its strong yellow colour. In Maharashtra, it is known as *Aboli* and as *Kanakambara* in Kannada. In a recent newspaper article, it was referred to as *Ambarakkeherida Kanakambara*, documenting the sky rise in market prices of this flower. Flowers are very popular because of their attractive bright colour and lightweight. It has a very high market demand, fetching higher prices in the Indian flower market (Ramachandrudu & Thangam, 2010) [14].

Organic farming may be a desirable proposition for improving the quality of horticultural produce. It may not be possible to maintain the quality of the produce in commercial horticulture, where the emphasis will be mainly on yield. It is impossible to meet the nutrient requirement of the crops exclusively through organic farming. Under these circumstances, integrated soil fertility management practices involving a judicious combination of organic manures, bio-fertilizers, and chemical fertilizers seem to be a feasible option for sustained horticulture on a commercial and profitable scale. In addition, they are eco-friendly, easily available and cost-effective. Bio-fertilizers are more appropriately called 'microbial inoculants', which contain live or latent cells of efficient strains of microorganisms. These may be biological nitrogen fixers, P-solubilizers, mineralization of nitrogen and transformation of several elements like sulphur and iron into available forms. These bio-fertilizers benefit agricultural production by supplying nutrients (Narasimharaju and Haripriya, 2001) [10].

2. Material and Methods

A local genotype with an orange colour was collected from the farmer's field of Irkalghada, and the same has been mentioned as 'Koppal local'. The experiment was conducted at the College of Horticulture, Munirabad of Koppal district. The material used and methodologies followed are explained here below. The experiment was conducted at the College of Horticulture, Munirabad, with ten treatments replicated three times. The planting was done in *Kharif* 2020 with a 60 cm X 30 cm spacing with recommended POP (100: 60: 60 kg NPK/ha+ FYM (25 t/ha). The design that followed was a randomized complete block design (RCBD). The RDF (Recommended Dose of Fertilizers) as per the Package of Practices recommended by the University of Horticultural Sciences, Bagalkot. Microbial consortium containing *Pseudomonas fluorescens* ($80x10^9$ cfu/ml), *Trichoderma harzianum* ($3x10^6$ cfu/ml) and *Azospirillum lipoferum* ($80x10^9$cfu/ml) were applied at the time of transplanting and subsequently at tri-monthly intervals @ every 2 litres per acre as soil drench application at the time of transplanting time. Humic acid (98%) @ 0.50 percent as soil drench was applied at the time of transplanting and subsequently at tri-monthly intervals. Well-decomposed farm yard manure (FYM) @ 25 tones per hectare was applied uniformly to all the experimental plots during the last ploughing and incorporated into the soil before planting the seedlings. The recommended dosage of nutrients *viz*., 100 kg Nitrogen, 60 kg Phosphorus and 60 kg Potash per ha were supplied completely through fertigation through drip using completely water soluble grade fertilizers, i.e. 19:19:19 and Urea in 40 split doses at weekly intervals was provided covering the entire cropping period. The total growth period has been divided into the vegetative growth phase (up to 15 weeks from transplanting) and the flowering phase (16 to 40 weeks after transplanting). During the vegetative growth phase, out of the total recommended dosage of nutrients, *viz*., 50 kg Nitrogen, 20 kg Phosphorus and 20 kg Potash per ha were supplied completely through fertigation through drip using completely water soluble grade fertilizers, *i.e.* 19:19:19 (105.30 kg) and Urea (65.2 kg) in 15 split doses at weekly interval was provided. Further, during the flowering phase, the remaining nutrients, *viz*., 50 kg Nitrogen, 40 kg Phosphorus and 40 kg Potash per ha, were supplied completely through fertigation through drip using completely water soluble grade fertilizers, i.e. 19:19:19 (210.5 kg) and Urea (21.7 kg) in 25 split doses at weekly interval.

3. Results and Discussion

The influence of fertigation on the growth parameters of Crossandra, *viz*., plant height, number of branches per plant, leaf area and plant spread (North-South, East-West), were analyzed and presented here under. The data about plant height at 120 days after transplantation in treatments, including different levels of recommended dosages of fertilizers (RDF) in combination with biofertilizers and humic acid, is depicted in Table 1. Analysis of the results indicated significant differences among the treatments for growth parameters in crossandra. The plant height varied from 17.03 cm to 42.73 cm at 120 DAT. The treatment T_6 (125% RDF + Biofertilizers) showed highest plant height of 42.73 cm and which was on par with treatments T_4-100% RDF + Biofertilizers (40.36 cm), T_9-125% RDF + Humic acid @ 0.5% (40.23 cm), T_7-100% RDF + Humic acid @ 0.5% (38.68 cm), T_3-125% RDF(38.13 cm) and treatment T_1-100% RDF (36.73 cm). In contrast, the lowest plant height of 17.03 cm was recorded with control.

The results concerning the number of primary branches produced per plant for different treatments are presented in Table 1. All the treatments differed significantly for the number of primary branches per plant at 120 DAT. Maximum number of primary branches per plant was recorded with treatment T_6-125% RDF + Biofertilizers (9.33) and which was on par with treatments T_9-125% RDF + Humic acid @ 0.5% (8.14), T_3-125% RDF (7.96) and T_4-100% RDF + Biofertilizers (7.96). The lowest number of primary branches per plant (3.6) was recorded in T_{10}-control. Similarly, the number of secondary branches per plant at 120 DAT varied significantly among all the treatments. Maximum number of secondary branches per plant (29.73) was recorded with the treatment T_6-125% RDF + Biofertilizers and which was on par with T_9-125% RDF + Humic acid @ 0.5% (27.13) and T_4-100% RDF + Biofertilizers (25.87). The lowest number of primary branches per plant (18.2) was recorded with T_{10} (control).

The results about plant spread in both East-West and North-South directions as influenced by different doses of RDF in combination with biofertilizers and humic acid have been analyzed and presented in Table 1. The treatment has shown significant variation for plant spread in the North-South direction at 120 days after transplanting, and it was observed in the range from 21.70 cm to 47.86 cm. The treatment T_6 (125% RDF + Biofertilizers) continued to grow with the widest canopy of 47.86 cm, which was on par with T_9-125% RDF + Humic acid @ 0.5% (45.69), T_4-100% RDF + Biofertilizers (45.14) and T_3-125% RDF (43.38). The least plant spread of 21.70 cm was observed in control (T_{10}).

Data about plant spread under different dosages of fertilizers are presented in Table 1. The treatments exhibited significant differences for plant spread in the East-West direction at 120 days after transplanting, and it was observed in the range of 23.11 cm to 59.75 cm. The treatment T_6 (125% RDF + Biofertilizers) exhibited the widest canopy of 59.75 cm, which was on par with T_9-125% RDF + Humic acid@ 0.5%) (53.44). Further, the least plant canopy spread of 23.11 cm was observed with the control treatment (T_{10}). The data for leaf area (cm^2) of different treatments for different doses of RDF in combination with biofertilizers and humic acid are furnished in Table 1. A significant difference was observed among the treatments. The leaf area was at its maximum (2374 cm^2) in treatment T_3-125% RDF, and the minimum leaf area was recorded in the control treatment (1889 cm^2).

This might be due to the increased C:N ratio, which has resulted in increased assimilation of photosynthates. This has enhanced the source-to-sink relationship and induced early transformation from the vegetative to the reproductive phase. Translocated nutrients from shoots to buds reduced the days taken for flowering in Gaillardia. The breakdown of apical dominance influenced by enhanced nutrient availability also impacted the faster bud initiation. Phosphorus is the essential nutrient for flowering in plants. Similar findings were reported in experiments done by Parmar *et al*. (2006) [16] in Gaillardia and Patel *et al.* (2015) [11] in Gaillardia.

Table 1: Vegetative parameters of crossandra as influenced by fertigation at 120 DAT

Treatment details	Plant height 120 DAT	Primary branches	Secondary branches	North-South (cm)	East-West (cm)	Leaf area (cm^2)
T_1-100% RDF	36.73	7.55	23.73	40.67	42.35	2139
T_2-75% RDF	31.88	6.63	20.33	35.03	35.11	2258
T_3-125% RDF	38.13	7.96	24.63	43.38	45.67	2374
T_4-100% RDF + Biofertilizers	40.36	7.96	25.87	45.14	50.61	2296
T_5-75% RDF + Biofertilizers	32.56	5.84	20.81	36.64	39.64	1992
T_6-125% RDF + Biofertilizers	42.73	9.33	29.73	47.86	59.75	2296
T_7-100% RDF + Humic acid @ 0.5%	38.68	7.55	25.33	44.70	48.12	2166
T_8-75% RDF + Humic acid @ 0.5%	32.64	5.67	21.44	37.03	38.35	2063
T_9-125% RDF + Humic acid@ 0.5%	40.23	8.14	27.13	45.69	53.44	2203
T_{10}-Control	17.03	3.60	18.20	21.70	23.11	1889
S. Em±	2.02	0.50	1.41	2.01	2.54	66.92
CD @ 5%	6.01	1.49	4.19	5.98	7.54	198.83

RDF: Recommended Dose of Fertilizer as per PoP, DAT: Days After Transplanting

Data about floral parameters like days for flower initiation, days to 50 percent flowering, days taken to first harvest and duration of flowering after transplanting are furnished in Table 2. Treatments differed significantly for the trait days taken to first flower spike initiation. The treatment T_9-125% RDF + Humic acid @ 0.5% was early to initiate the flower spike in 86.61 days after transplanting, which was on par with all other treatments except T_{10}-control and which was late (100.33 DAT) to initiate the flowering. The treatments differed significantly for days taken to 50 percent flowering. The treatment T_9-125% RDF + Humic acid @ 0.5% was early to attain 50 percent flowering stage in 98.94 days after transplanting, and the control (T_{10}) was late to attain 50 percent flowering stage (113.33 DAT). The treatments differed significantly for days taken to the first harvest. The treatment T_2-75% RDF was early to harvest in 83.25 days after transplanting and was statistically on par with T_8-75% RDF + Humic acid @ 0.5% (87.67), T_3-125% RDF (88.33) and T_1-100% RDF (86.33), whereas control (T_{10}) was late to harvest the flowers (96.45 DAT). Results revealed the existence of significant variation concerning the duration of flowering among fertilizer dosage treatments in combination with biofertilizers. Duration of flowering was maximum (29.45 days) in the treatment T_6-125% RDF + Biofertilizers, and it was on par with all the treatments except control (T_{10}), which recorded the least number of total flowering days (18.11 days).

It reduced the days taken for flowering. Biofertilizers produced in RDF also resulted in early flowering in gailardia. The results are in line in line with the research findings of Patil *et al*. (2020) [12] in Chrysanthemums, Prasad *et al.* (2018) [13] in Dahlia, and Bose *et al*. (2018) [4] in China aster.

Table 2: Flowering parameters of crossandra as influenced by fertigation

Treatment details	Days for flower initiation	Days to 50 percent flowering	Days taken to first harvest	Duration of flowering (days)
T_1-100% RDF	90.67	108.01	94.25	26.61
T_2-75% RDF	92.67	110.76	96.33	25.33
T_3-125% RDF	91.33	106.01	94.45	26.15
T_4-100% RDF + Biofertilizers	88.67	104.13	91.67	27.35
T_5-75% RDF + Biofertilizers	91.33	105.81	94.67	26.33
T_6-125% RDF + Biofertilizers	87.67	99.13	91.25	29.45
T_7-100% RDF + Humic acid @ 0.5%	92.45	105.31	96.33	27.67
T_8-75% RDF + Humic acid @ 0.5%	91.33	108.99	94.75	26.19
T_9-125% RDF + Humic acid@ 0.5%	96.61	105.2	100.33	28.57
T_{10}-Control	98.33	119.21	102.33	18.11
S. Em±	1.87	1.49	1.45	1.38
CD@ 5%	5.56	4.42	4.32	4.11

RDF: Recommended Dose of Fertilizer as per PoP, DAT: Days After Transplanting

The data about yield parameters like number of flowers per spike, number of spikes per plant, spike length, 100 flower weight, flower yield per plant and flower yield per plot are presented in Table 3. Results revealed a significant variation among the treatments, including the use of different dosages of fertilizers concerning the number of flowers per spike. Production of flower per spike was maximum (28.35) in T_6-125% RDF + Biofertilizers and which was on par with the treatment T_9-125% RDF + Humic acid @ 0.5% (27.34), T_4-100% RDF + Biofertilizers (26.63), T_7-100% RDF + Humic acid @ 0.5% (25.43), T_3-125% RDF (24.87) and T_1-100% RDF (24.63), while production of flowers per spike was minimum (18.33) with the control treatment (T_{10}). Data on spikes per plant for different treatments, including different dosages of fertilizers, is presented in Table 3. A significant difference was noticed among the treatments concerning the number of spikes per plant. The number of spikes per plant was recorded from 75.67 to 120.25. The treatment T_6-125% RDF + Biofertilizers had the maximum number of spikes per plant (120.25), and it was on par with T_4-100% RDF + Biofertilizers (115.36), T_7-100% RDF + Humic acid @ 0.5% (111.25) and T_3-125% RDF (105.24). The least number of spikes per plant was observed in control (75.67).

The optimum dose (RDF) of NPK and biofertilizers was needed to induce early and maximum flowering duration. Due to their increased accumulation in plant parts, the continuous supply of nutrients encouraged the long duration of flowering. Thumar *et al*. (2013) [15] also reported similar experimental results in Marigold and Garge *et al*. (2019) [6] in French Marigold.

Results revealed that significant variation concerning spike length was noticed among treatments, including using different dosages of fertilizers. Spike length was maximum (8.21 cm) in T_6-125% RDF + Biofertilizers which was on par with the treatment T_9-125% RDF + Humic acid @ 0.5% (8.01 cm), T_4-100% RDF + Biofertilizers (7.62 cm) and T_3-125% RDF (7.20 cm) while spike length production was minimum (4.21 cm) with the control (T_{10}). The parameter weight of 100 flowers (g) also varied significantly among the treatments with different dosages of fertilizers. The maximum weight of 100 flowers was observed in T_6-125% RDF + Biofertilizers (6.85 g), which was on par with T_9-125% RDF + Humic acid @ 0.5% (6.53 g) and T_4-100% RDF + Biofertilizers (6.01 g). In comparison, the lowest weight of 100 flowers (4.25 g) was recorded in the T_{10} (control). Treatments differed significantly for flower yield per plant (g). The treatment T_6-125% RDF + Biofertilizers recorded maximum flower yield per plant (140.68 g), which was on par with T_9-125% RDF + Humic acid @ 0.5% (137.52 g) and T_7-100% RDF + Humic acid @ 0.5% (132.65 g). In contrast, the control treatment (T_{10}) was recorded at a minimum (65.67 g). A significant difference was observed concerning flower yield per plot (kg). The treatment T_6-125% RDF + Biofertilizers recorded the maximum flower yield per plot (2.38 kg), and it was on par with the treatment T_9-125% RDF + Humic acid @ 0.5% (2.18 kg). The minimum flower yield per plot of 0.96 kg was recorded with control (T_{10}). There was a significant difference in flower yield per hectare. The treatment T_6-125% RDF + Biofertilizers recorded the maximum flower yield per hectare (3303.44 kg), which was on par with the remaining treatments used in the study. The minimum flower yield per hectare (1332.48 kg) was recorded in the control treatment (T_{10}).

Colonization by mycorrhizal fungi also increases root surface area, thus triggering higher nutrient acquisition. The enhanced source-to-sink relationship also promoted the flower quality parameters in Gaillardia. The experimental results are by the studies of Gadagi *et al.* (2004) [5] in marigold, Patel *et al.* (2015) [11] in gaillardia, Koli and Jayanthi (2018) [8] in marigold. This might be due to the activities of humic acid and biofertilizers. Increased flower diameter and corolla length resulted in maximum individual flower weight. The experimental results are based on the findings of Mittal *et al.* (2010) [9] in Marigold, Koli and Jayanthi (2018) [8], and Kaushik and Singh (2020) [7] in Marigold.

Table 3: Influence of different dosages of fertilizers on the floral parameters of crossandra

Treatment details	No. of flowers per spike	No. of spikes per plant	Spike length (cm)	100 flowers weight (g)	Flower yield (g/plant)	Flower yield (kg/plot)	Flower yield (kg/ha)	B:C ratio
T_1-100% RDF	24.63	101.30	6.33	5.60	95.33	1.75	2429.00	2.01
T_2-75% RDF	21.65	85.25	4.58	5.41	75.85	1.23	1707.24	1.55
T_3-125% RDF	24.87	105.24	7.20	5.75	110.25	1.92	2664.96	2.13
T_4-100% RDF + Biofertilizers	26.63	115.36	7.62	6.01	135.25	2.04	2831.52	2.23
T_5-75% RDF + Biofertilizers	22.45	98.23	5.82	5.51	90.51	1.45	2012.60	1.75
T_6-125% RDF + Biofertilizers	28.35	120.25	8.21	6.85	140.68	2.38	3303.44	2.45
T_7-100% RDF + Humic acid @ 0.5%	25.43	111.25	6.71	5.85	132.65	1.95	2706.60	2.17
T_8-75% RDF + Humic acid @ 0.5%	21.68	95.67	5.41	5.46	86.22	1.33	1846.04	1.64
T_9-125% RDF + Humic acid @ 0.5%	27.34	98.68	8.01	6.53	137.52	2.18	3025.84	2.32
T_{10}-Control	18.33	75.67	4.21	4.25	65.67	0.96	1332.48	1.31
S. Em ±	1.46	6.26	0.44	0.36	6.25	0.1	10.50	
CD @ 5%	4.33	18.59	1.30	1.08	18.56	0.31	31.21	

RDF: Recommended Dose of Fertilizer as per PoP, DAT: Days After Transplanting

4. Conclusion

Based on the outcome of the present investigation, integrated nutrient management significantly influenced the growth and yield attributes of Crossandra. To obtain better yield and quality in Crossandra, the crop has to be provided with 125 percent RDF as fertigation in split doses and biofertilizers (microbial consortium) as soil drench at a tri-monthly interval. At the same time, control plants had a minimum. Thus, the integral use of inorganic fertilizers and biofertilizers can be recommended to achieve maximum sustainable flower yield in Crossandra.

5. References

1. Ambika K. Integrated Nutrient Management on Growth, Yield and Quality of Crossandra (*Crossandra undulaefolia* Salisb.) Hybrid Arka Ambara [dissertation]. Bangalore: University of Agricultural Sciences, GKVK; c2018.
2. Anonymous. National Horticulture Board, Area and production of Horticulture crops (3rd Advance estimate); c2016.
3. Ashwath T, Rao M, Ramachandran N. Promising crossandra (*Crossandra undulaefolia* Salisb.) F1 hybrids IIHR 2004-09 and 2004-11. J Orn Hort. 2007;10(1):64-66.
4. Bose BSC, Prasad VM, Prasad DSH, Sudha G. Effect of integrated nutrient management on growth of the China aster (*Callistephus chinensis* L. Nees) cv. Pit and pot. Plant Arch. 2018;18(1):676-678.
5. Gadagi RS, Krishnaraj PU, Kulkarni JH, Sa-Tong M. Combined Azospirillum inoculation and nitrogen fertilizer affect plant growth promotion and yield response of the blanket flower *Gaillardia pulchella*. Sci Hortic. 2004;100:323-332.
6. Garge VC, *et al*. Effect of integrated nutrient management on French marigold (*Tagetes patula* L.) cv flower quality. Pusa Arpita. Int J Pure Appl Chem. 2020;21(24):154-158.
7. Kaushik H, Singh JP. Impact of integrated nutrient management (INM) on African Marigold's plant growth and

flower yield (*Tagetes erecta* L.). J Pharmacogn Phytochem. 2020;9(4):1481-1484.

8. Koli R, Jayanthi R. Influence of integrated nutrient management on flower yield and economics of marigold (*Tagetes erecta* L.) cv. Pusa Basanti Gainda. Int J Chem Stud. 2018;6(4):2651-2653.
9. Mittal R, Patel HC, Nayee DD, Sitapara HH. Effect of integrated nutrient management on growth and yield of African marigold (*Tagetes erecta* L.) cv. 'Local' under middle Gujarat agro-climatic conditions. Asian J Hort. 2010;5(2):347-349.
10. Narasimharaju S, Haripriya K. Integrated nutrient management in crossandra (*Crossandra infundibuliformis* L.) cv. Dindigul local. S Indian Hort. 2001;49:181.
11. Patel AS, Leua HN, Parekh NS, Patel HC. Effect of integrated nitrogen management on Gaillardia's growth, flowering, and flower yield (*Gaillardia pulchella* Foug.) cv. 'Lorenziana' under middle Gujarat conditions. Asian J Hort. 2015;10(1):126-129.
12. Patil D, Dalal SR, Mahadik MK. The growth, flowering, and economics of chrysanthemum cultivation are influenced by integrated nutrient management. Int J Chem Stud. 2020;9(1):313-316.
13. Prasad DHS, Prasad VM, Goutham SK, Bose SC. Effect of integrated nutrient management on flowering and flower yield of dahlia (*Dahlia variabilis* L.) cv. Kenya Orange. Plant Arch. 2018;18(1):795-798.
14. Ramachandrudu K, Thangam M. Characterization and evaluation of local germplasm of crossandra (*Crossandra undulaefolia* Salisb.). J Orn Hort. 2010;13(2):138-141.
15. Thumar BV, Barad AV, Neelima P, Bhosale N. Effect of integrated system of plant nutrition management on growth, yield and flower quality of African marigold (*Tagetes erecta* L.) cv. Pusa Narangi. Asian J Hort. 2013;8(2):466-469.
16. Machin D, Cheung YB, Parmar M. Survival analysis: a practical approach. John Wiley & Sons; c2006 Mar 30.