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Payal Sahu
Department of Floriculture and Landscape Architecture, Indira Gandhi Krishi Vishwavidayalaya, Raipur, Chhattisgarh, India

T Tirkey
Department of Floriculture and Landscape Architecture, Indira Gandhi Krishi Vishwavidayalaya, Raipur, Chhattisgarh, India

Jitendra Kumar Sahu
Department of Floriculture and Landscape Architecture, Indira Gandhi Krishi Vishwavidayalaya, Raipur, Chhattisgarh, India

Corresponding Author:
Payal Sahu
Department of Floriculture and Landscape Architecture, Indira Gandhi Krishi Vishwavidayalaya, Raipur, Chhattisgarh, India

Evaluation of combined effect of organic manure and biofertilizers on growth and floral attribute of chrysanthemum (*Dendranthema grandiflora* Tzelev) cv. Maa white in Pot culture

Payal Sahu, T Tirkey and Jitendra Kumar Sahu

Abstract
The present experiment entitled "Evaluation of combined effect of organic manure and biofertilizers on growth and floral attribute of Chrysanthemum (*Dendranthema grandiflora.* Tzelev) cv. Maa White in pot culture" was conducted at Horticulture nursery and Floriculture laboratory, Department of Floriculture and Landscape Architecture, College of Agriculture, IGKV, Raipur, Chhattisgarh during 2019-20 in Completely Randomized Design (CRD) with nine treatments and three replication constituting various organic manures and inorganic manures as control.
Although implementation of T_9 (Vermicompost + *Azospirillum* + Azotobacter + Phosphate Solubilizing Bacteria + 50% RDF) nutrient combination in potted chrysanthemum showed minimal days to first bud appearance although it significantly increased the majority of characters. Therefore, it may be inferred that for organic treatments, T_9 treatment is found to be superior and it could be proposed for chrysanthemum pot culture combined with different nutrient combinations.

Keywords: chrysanthemum, *Dendranthema grandiflora*, combination of different nutrients

Introduction
Plant Chrysanthemum (*Dendranthema grandiflora* Tzvelev) belongs to family Asteraceae, originated from Asia and North Eastern Europe. This flower known to be a delightful and serve as oldest exquisite flower. "Queen of East" is the title given to this flower. Phenotypically this plant is tall, stand upright erectly and can be used as border crop. It is an open pollinated crop with chromosome number, 2n = 36, 45, 47, 51. This flower is as important as rose commercially as it stands next after rose. Conventionally, production in flowers being increased by the use of massive use of high yielding varieties and incorporating heavy doses of chemical fertilizer in the recent decades. However, this has resulted in deterioration of physio-chemical properties of soil, increased pollution of soil and water bodies eventually leading it difficult to sustain profitable farming. As we know that high yielding varieties can grow well only in healthy soils, hence it is important for the farmers to maintain productive soils for benefit in flower production. Starter solutions are dilute solutions of fertilizer or manures applied to plants at time of transplanting. Therefore, we are now diverting our mind towards the use of mixtures providing organic minerals like farmyard manure, compost of earthworm and biofertilizers like *Azospirillum* and Phosphate Solubilizing Bacteria (PSB). To obtain the ample increase in yield and quality measures of flower. In chrysanthemum, the use of bio- fertilizers *viz.*, *Azospirillum* and Phospho-bacteria mixed with organic manures with optimum amount of use of chemical fertilizers or even avoiding the use of them, may be one of the most important management approaches.

Materials and Methods
The present investigation was conducted at the Department of Floriculture and Landscape Architecture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during winter season of the year 2019-20. The experiment was laid out in completely randomized design with 3 replication and 9 treatment combinations. The details of the treatments applied in the present investigation are as under:

Table 1: Treatment Details

S. No.	Notation	Treatments
1	T_1	100% Recommended dose of fertilizer
2	T_2	Mushroom Waste + 50% Recommended dose of fertilizer
3	T_3	FYM + 50% Recommended dose of fertilizer
4	T_4	Cocopeat + 50% Recommended dose of fertilizer
5	T_5	Vermicompost + 50% Recommended dose of fertilizer
6	T_6	Mushroom Waste + *Azospirillum* + Azotobacter + PSB+ 50% RDF
7	T_7	FYM + *Azospirillum* + Azotobacter + PSB+ 50% RDF
8	T_8	Cocopeat + *Azospirillum* + Azotobacter + PSB+ 50% RDF
9	T_9	Vermicompost + *Azospirillum* + Azotobacter + PSB+ 50% RDF

Where,
T_1 proposed as control
RDF-Recommended Dose of Fertilizer
PSB-Phosphorus Solubilizing Bacteria

After filling the pots with growing media containing soil and growing media in 2:1 ratio, the rooted cuttings of chrysanthemum plants (cv. Maa white) was planted in pots. Watering was done just after planting and subsequent irrigation was given at alternate days throughout the entire crop period through water can. During the entire crop period, cultural operations were done as and when required. These mixtures were prepared at the time of transplanting. Solution of PSB was prepared by mixing 5 g of PSB, Azotobacter, *Azospirillum*, in 1 liter of water. It was directly applied in the growing media in pots at the rate of 50 ml per pot. In total 135 pots these biofertilizer mixture was applied and T_1 was used as controlled in which only recommended dose of fertilizer was used. Five plants was selected at random from each treatment and tagged for recording the observations. Observations should be recorded as per as appropriate method. Required observations was recorded from each replication of different treatments and average value was calculated. The analysis of variance for experimental design was carried out for all the characters under study.

Results and Discussion

The experimental findings obtained from the present study have been discussed here in following heads:

Effect on growth parameters

The data pertaining to various growth characters viz., plant height (cm), number of primary and secondary branches per plant, number of leaves and plant spread (cm) clearly indicated that the chrysanthemum plant showed significant response and presented in Table 2 and 3.

- The treatment effect showed significant effect on plant height at (20, 40 and 60 DAP). Remarkably tallest plant (14.40, 28.80 and 32.60 cm) was observed on plants applied with treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF) at 20, 40 and 60 DAP respectively. Whereas, the lowest plant height (12.30, 23.20 and 26.20 cm) noted in treatment T_1 (100% Recommended dose of fertilizer) as different combination of nutrients in 20, 40 and 60 DAP respectively.
- The treatment effect showed significant effect on number of primary branches at initial stage (20, 40 and 60 DAP). Maximum number of primary branches (5.40, 6.90 and 8.80) was recorded on application of treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB + 50% RDF) at 20, 40 and 60 DAP respectively. Whereas, minimum number of primary branches per plant (3.10, 5.20 and 7.30) observed with application of treatment T_1 (100% Recommended dose of fertilizer) at 20, 40 and 60 DAP respectively.
- Maximum number of secondary branches per plant (10.80, 13.80 and 17.70) was noted on application of treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF) at 20, 40 and 60 DAP respectively. Minimum number of secondary branches per plant (6.20, 10.40 and 14.60) was observed with application of treatment T_1 (100% Recommended dose of fertilizer) at 20, 40 and 60 DAP respectively.
- Application of different combination of nutrients showed significant effect on number of leaves at initial stage (20, 40 and 60 DAP). Maximum number of leaves per plant (27.90, 36.90 and 41.00) was noted on application of treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF) at 20, 40 and 60 DAP respectively. However, minimum number of leaves per plant (15.40, 23.70 and 26.10) was observed with application of treatment T_1 (100% Recommended dose of fertilizer) at 20, 40 and 60 DAP respectively.
- Maximum plant spread (24.40 cm) was noted on application of treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF) which was significantly superior over all the other treatments including control. Minimum plant spread (20.00 cm) was observed with application of treatment T_1 (100% Recommended dose of fertilizer).

The better performance in growth parameters may be because organic manures improves the micro flora, micronutrient availability and enzymatic activity, which might have augmented the plant growth. PSB makes fixed soil phosphorus available to plants and produces plant growth regulating substances, which promotes growth and development of the plant. Phosphobacteria enhances the cell division and cell enlargement, which might have stimulated plant growth. Biofertilizers like PSB provides an economically viable and ecological sound means of reducing or helping external input of chemical fertilizers. Increase in plant spread may also be due to enhanced photosynthetic activity and stimulation of branching resulting in more no. of primary and secondary branches, thereby, increasing the plant spread. These results are in close agreement with Warade *et al.* (2007) in dahlia, Lambat and Pal (2012) in rose, Mummigatti *et al.* (2011) and Bellubi *et al.* (2015) in chrysanthemum, Prem kumar *et al.* (2016) and Rongting J. *et al.* (2017) in chrysanthemum, and Patel *et al.* (2017) in rose.

Effect on flowering and yield parameters

The data pertaining to various flowering attributes clearly indicated that the chrysanthemum plant showed significant response and presented in Table 4 and 5.

- Minimum day to first bud appearance (23.00 cm) was noted on application of treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF) which

was significantly superior over all the other treatments including control. Maximum day to first bud appearance (28.00 cm) was observed with application of treatment T_1 (100% Recommended dose of fertilizer).

- There was significant variation on number of buds per plant due to the application of different combination of nutrients. Maximum number of buds per plant (10.81) was noted on application of treatmentT_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF). Minimum number of buds per plant (7.53) was observed with application of treatment T_1 (100% Recommended dose of fertilizer).
- The minimum days for opening of first flower (26.30) was observed with application of treatment T9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB + 50% RDF). Maximum days for opening of first flower (29.70) was noted on application of treatment T1 (100% Recommended dose of fertilizer).
- Highest number of flowers per plant (9.10) was noted on application of treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF) while lowest number of flowers per plant (5.90) was observed with application of treatment T_1 (100% Recommended dose of fertilizer).
- Maximum flower diameter (6.90 cm) was recorded at treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF). Whereas, minimum flower diameter (5.30 cm) was observed with application of treatment T_1 (100% Recommended dose of fertilizer).
- Treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF) recorded maximum average flower weight (5.70 g). Minimum flower weight (3.37 g) was observed with application of treatment T_1 (100% Recommended dose of fertilizer).
- Maximum stalk length (9.20cm) was found at treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF) which was *at par* with treatment T_3, T_5, T_7, T_8 and it showed significant difference with rest of the treatments including control. However, minimum flower weight (8.30 cm) was observed with application of treatment T_1 (100% Recommended dose of fertilizer)
- Maximum flower yield per plant (49.10 g) was recorded with treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF). Whereas, minimum flower yield per plant (28.00 g) was recorded in the treatment T_1 (100% Recommended dose of fertilizer).
- Longer duration of flowering (50.60 days) was noted on application of treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF). Shortest duration of flowering (40.00 days) was recorded in the treatment T_1 (100% Recommended dose of fertilizer).

The greater number of buds might be due to possible role of Vermicompost, *Azospirillum*, *Azotobacter*, PSB, 50% RDF through better availability of micro-nutrients and enhanced nutritional uptake which might have resulted in more photosynthesis enhancing food accumulation and consequently formation of more number of flower buds. Balanced nutrition at optimum level might have caused increased physiological activity of plants, thereby increasing number of flower bud formed in plants. These results are in conformity with the findings of Patel *et al.* (2017) in rose, Awodun *et al.* (2018). Maximum number of flowers may be due to fast release of nutrients and the addition of organic nutrients increase moisture content of the soil and retained it for a longer duration. It also improved physical, chemical and microbial properties of soil and there by its productivity. The number of flowers per plant may have enhanced with the rise in the number of branches per plant and the impact of inoculants capable of providing phosphorus present in soil in order to increase the number of flowers per plant. Co-inoculation of PSB with *Azospirillum* and *Azotobacter* in the form of starter solution might have mobilized phosphate to a significantly higher extent than individual treatment, possibly due to enhanced rhizospheric activity leading to the production of more number of flowers per plant. Higher yield per plant was obtained on the particular treatment due to increase in traits, which positively attributed longer nutrient availability to the plant because of supplementation of biofertilizer like PSB as well as organic manure like *Azospirillum* and *Azotobacter*. More or less the above findings are in agreement with the results of Doral *et al.* (2004) in gerbera, Kumar *et al.* (2006) in marigold, Awodun *et al.* (2007) in capsicum, Valia *et al.* (2011) in marigold and Kumar *et al.* (2014) in gladiolus and Patel *et al.* (2017) in rose.

Table 2: Effect of different nutrient mixtures on number on plant height, no. of primary leaves and secondary leaves of chrysanthemum at 20, 40 and 60 DAP

Treatment	Plant height (in cm)			Number of pri. Leaves			Number of sec. leaves		
	20 DAP	40 DAP	60 DAP	20 DAP	40 DAP	60 DAP	20 DAP	40 DAP	60 DAP
T1	12.30	23.20	26.20	3.10	5.20	7.30	6.20	10.40	14.60
T2	12.60	23.80	27.30	3.30	6.10	8.60	6.60	12.30	17.20
T3	13.07	23.80	27.80	4.20	6.10	7.80	8.50	12.20	15.60
T4	12.87	25.50	28.20	4.50	5.90	7.80	9.00	11.90	15.70
T5	13.87	24.40	28.50	4.60	6.00	8.20	9.30	12.10	16.40
T6	13.86	24.10	28.20	4.70	5.90	7.60	9.50	11.80	15.20
T7	14.20	28.60	31.90	5.20	6.70	8.30	10.40	13.40	17.40
T8	13.96	23.60	28.80	4.70	5.80	7.80	9.40	11.50	15.50
T9	14.40	28.80	32.60	5.40	6.90	8.80	10.80	13.80	17.70
SEm±	0.33	0.57	0.63	0.28	0.14	0.24	0.11	0.26	0.12
CD @ 5%	1.00	1.71	1.89	0.85	0.44	0.73	0.33	0.78	0.36

Table 3: Effect of different nutrient mixtures on number of leaves per plant of chrysanthemum at 20, 40 and 60 DAP

Treatment	Number of leaves			Avg. plant spread
	20 DAP	40 DAP	60 DAP	
T1	15.40	23.70	26.10	20.00
T2	18.40	24.30	27.60	21.20
T3	19.30	27.00	30.10	23.60
T4	15.40	22.10	25.60	21.50
T5	20.20	24.30	30.70	23.70
T6	21.20	29.70	32.90	23.6
T7	27.60	34.90	40.30	21.90
T8	27.10	33.30	36.90	21.50
T9	27.90	36.90	41.00	24.40
SEm±	1.22	1.69	1.45	0.50
CD @ 5%	3.65	5.03	4.32	1.49

Table 4: Effect of different nutrient mixtures on following traits of chrysanthemum at 20, 40 and 60 DAP

Treatments	Avg. days to first flower bud appearance	Avg. no. of buds per plant	Avg. opening of first flower	Avg. no. of flowers per plant	Avg. flower diameter (cm)
T_1	28.00	7.53	29.70	5.90	5.30
T_2	25.30	8.87	29.30	6.00	5.50
T_3	26.30	8.96	29.00	6.80	6.10
T_4	24.30	8.70	29.50	6.70	5.40
T_5	25.30	9.60	28.00	7.07	6.60
T_6	25.00	9.33	27.70	7.66	6.40
T_7	23.60	9.87	27.30	8.70	6.80
T_8	23.80	8.47	27.50	8.30	6.30
T_9	23.00	10.81	26.30	9.10	6.90
$SE_{m\pm}$	0.89	0.31	0.96	0.42	0.20
C.D. at 5%	2.64	0.92	2.85	1.25	0.60

Table 5: Effect of different nutrient mixtures on following traits of chrysanthemum at 20, 40 and 60 DAP

Treatments	Avg. flower weight per plant (gm)	Avg. flower stalk length(cm)	Avg. flower yield per plant (g)	Avg. duration of flowering
T_1	3.37	8.30	28.00	40.00
T_2	3.93	8.60	30.00	41.70
T_3	4.25	8.80	29.90	42.70
T_4	4.47	8.40	27.10	43.70
T_5	4.93	9.00	30.40	44.00
T_6	4.69	8.60	32.20	45.70
T_7	5.63	9.00	38.50	46.30
T_8	5.30	8.80	35.20	46.30
T_9	5.70	9.20	49.10	50.70
$SE_{m\pm}$	0.26	0.17	1.17	1.12
C.D. at 5%	0.78	0.52	3.49	3.33

Conclusion

Organic manures when combined with biofertilizers used as mixture of nutrients on flower have many benefits. In addition to enhancing soil structure and texture, reducing soil pollution owing to decreased implementation of fertilizer, which is useful to the current issues of elevated fertilizer costs and environmental pollution, organic manures also improved vegetative and floral parameters, increased vase life and yield. On comparing the organic treatments, treatment T_9 (Vermicompost + *Azospirillum* + *Azotobacter* + PSB+ 50% RDF) was found to be superior over other treatments for majority of vegetative and floral parameters, followed by treatment T_7 (FYM + *Azospirillum* + *Azotobacter* + Phosphate Solubilizing Bacteria + 50% RDF). Therefore, it may be concluded that as far as organic treatments are concerned, treatment T_9 is found to be superior and observing the better performance of treatment T_9 in majority of parameters, it may be recommended for pot culture combined with different nutrient mixtures.

Reference

1. Ajitkumar. Effect of organic and inorganic fertilizers on growth, yield and postharvest life of marigold. M. Sc. (Ag.) Thesis, UAS, Dharwad; c2002.
2. Angadi P. Integrated nutrient management studies on growth, yield and quality of garland chrysanthemum (*Chrysanthemum coronarium* L.). M.Sc.(Ag.) Thesis, UAS, Dharwad; c2010.
3. Anonymous. Chhattisgarh Database, Directorate of Horticulture. Government of Chhattisgarh, Raipur; c2016.
4. Anuje AA, Doral SR, Gonge US, Renuka M. Effect of growing media on growth, flowering and yield of gerbera under polyhouse condition. The Orissa J of Hort. 2004;32(2):172-175.
5. Arancon NQ, Lee S, Edwards CA, Atiyeh R. Effects of humic acids derived from cattle, food and paper-waste vermi composts on growth of greenhouse plants. Pedobiologia. 2003;47(5-6):741-744.
6. Asokan R, Sukhada M, Lalitha A. Bio fertilizers and bio

pesticides for horticultural crops. Indian Hort. 2000;45(1):44-47.
7. AVRDC. Progress Reports 1998-2003. Asian Vegetable Research and Development Center, Shanhua, Taiwan; c2004.
8. Awodun MA, Omonijo LI, Ojeniyi SO. Effect of Goat dung and NPK Fertilizer on Soil and Leaf Nutrient Content Growth and Yield of Pepper. International Journal of Soil science. 2007;2:142-147.
9. Baghel BS, Yadav R, Tiwari R, Gupta N. Response of phalsa (*Grewia subinaequalis*) cutting to bio fertilizers and rooting media. Indian J Hort. 2004:61(1):89-91.
10. Baviskar MN, Bharad SG, Dod VN, Varsha GB. Effect of integrated nutrient management on yield and quality of sapota. Plant Archives. 2011;11(2):661-663.
11. 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. International Journal of Agriculture Sciences and Veterinary Medicine. 2015;1(1):69-74.
12. Belgaonkar DV, Bist MA, Wakde MB. Effect of levels of nitrogen and phosphorus with different spacings on growth and yield of annual chrysanthemum. Journal of Soils and Crops. 1996;6:154-158.
13. Bohra M, Kumar A. Studies on effect of organic manures and bioinoculants on vegetative and floral attributes of chrysanthemum cv. Little Darling. An International Quarterly Journal of Life Science. 2014;9(3):1007-1010.
14. Chaitra R, Patil VS. Integrated nutrient management studies in China aster (*Callistephus chinensis* Nees) cv. Kamini. Karnataka J Ag. Sci. 2007;20(3):689-690.
15. Chattopadhyay A. Effect of Vermiwash and Vermicompost on an Ornamental Flower, Zinnia sp.J Horticulture. 2014;1:112. DOI: 10.4172/2376-0354.1000112
16. Chougala V. Integrated nutrient management studies in double daisy (*Aster amellus* L.*).* M.Sc. (Ag.) Thesis, UAS, Dharwad, Karnataka; c2011.
17. Dar Rukhsara, Gupta AK, Chopra S, Samnotra RK. Effect of integrated nutrient management on seed yield of okra [*Abelmoschus esculentus* (L).Moench]. Journal of Research, SKUAST–J. 2010;9(1):70-78.
18. Dadoshpor AJ Mohammad. Impact of integrated organic nutrient handling on fruit yield quality of strawberry. J Ornam. Hort. 2012;2(4):251-256.
19. Deshmukh PG, Khiratkar SD, Badge SA, Bhongle SA. Effect of bio- inoculants with graded doses of NPK on growth and yield of gaillardia. Journal of Soils and Crops. 2008;18(1):212-216.
20. Dhane SS, Sonawane SP, Dabke DJ, Dabke SB. Effect of nitrogen, phosphorus and FYM on yield and nutrient uptake by China aster (*Callistephus chinensis* (L.) Ness). J Maha. Agri. Univ. 2009;34(1):90-91.
21. Doral SR, Anuje AA, Gonge US, Renuka M. Effect of growing media on growth, flowering and yield of gerbera under polyhouse condition. The Orissa J of Hort. 2004;32(2):172-175.
22. Golliwar VJ, Ashwini P, Warede Neha, Chopde PW, Lanje, Thakre SA. Effect of organic manures and bio fertilizer on growth, flowering and tuberous root production of Dahlia. J Soils and Crops. 2007;17(2):354-357.
23. Gupta AK, Tripathi VK. Efficacy of Azotobacter and vermicompost alone and in combination on vegetative growth, flowering and yield of strawberry (*Fragaria x ananassa* Duch.) cv. CHANDLER. Prog. Hort. 2012;44(2):256-261
24. Harkers RL, Hidalgo PR. Earthworms eating as a substrate amendment for chrysanthemum production. Hort. Sciences. 2002;37(7):1035-1039.
25. Hemavathi M. Effect of organic manures and biofertilizers on growth and productivity of chrysanthemum (*Chrysanthemum morifolium* Ramat.). cv. Local yellow. *M. Sc. (Ag.) Thesis*, UAS, Dharwad, Karnataka; c1997.
26. Jayaprasad KV, Nethra NN, Radha DK. China aster (*Callistephus chiensis*(L.) Nees) cultivation using vermicompost as organic amendment. Crop Res. 1999;17(2):209-215.
27. Kolambe SV. Effect of organic manures and bio fertilizers on growth, flowering, yield and quality of Rose (*Rosa hybrida* L.) under South Gujarat condition. *M.Sc. (Agri.). Thesis*, NAU, Navsari; c2008.
28. Kumar A, Prasad VM, Singh D, Bahadur V, David AA, Beer K. Effect of Bio-Fertilizers, Vermicompost and *Trichoderma* on Yield and Economics of Strawberry (*Fragaria x annanasa* Duch.) cv. Sweet Charlie. Int. J Curr. Microbiol. App. Sci 2018;7(06):1534-1538. Doi:https://doi.org/10.20546/ijcmas.2018.706.182
29. Kumar D, Singh BP, Singh VN. Effect of integrated nutrient management on growth, flowering behaviour and yield of African marigold (*Tagetes erecta* L.) cv. African Giant Double. J Hort. Sci. 2009;4(2):134-137.
30. Kumar M, Sharma SK, Singh S, Dahiya DS, Mohammed S, Singh VP. Effect of farmyard manure and different bio fertilizers on yield and nutrient content of marigold cv. Pusa Narangi. Haryana J Hort. Sci. 2006;35(3-4):256-257.
31. Kumar P, Raghava SPS, Mishra RL. Effect of bio fertilizers on growth and yield of China aster. J Orn. Hort. 2003;6(2):85-88.
32. Kumar SR, Pradeep K. Effect of organic nutrients on growth, flowering and yield of *Gladiolus grandiflorus* L. Asian J Hort. 2014;9(2):416-420.
33. Kolambe SV. Effect of organic manures and bio fertilizers on growth, flowering, yield and quality of Rose (*Rosa hybrida* L.) under South Gujarat condition. M.Sc. (Agri.). Thesis, NAU, Navsari; c2008.
34. Laishram N. Studies on integrated nutrient management for commercial flower production of chrysanthemum (*Dendranthema grandiflora* Tzvelev.). *M.sc. (Ag) Thesis.*YSP Uni. of Hort. & For., Nauni, Solan; c2011.
35. Laishram N, Dhiman SR, Gupta YC, Bhardwaj SK, Singh A. Microbial dynamics and physico-chemical properties of soil in the rhizosphere of chrysanthemum (*Dendranthema grandiflora*) as influenced by integrated nutrient management. Indian J of Ag. Sci. 2013;83(4):447-455.
36. Lambat HS, Pal P. Effect of organic manures and bio fertilizers on growth and flowering of *Rosa* cv. Madgod. Journal of Crop and Weed. 2012:8(2):137-138.
37. Manivannan K, Pradeep Keisam, Kumar S. Ramesh Effect of organic nutrients on growth, flowering and yield of *Gladiolus grandiflorus* L. Asian J Hort. 2014;9(2):416-420

38. Mashaldi A. Effect of organic and inorganic fertilizers on growth, yield and post- harvest life of marigold (*Tagetes erecta* L.) cv. Double orange. *M. Sc. (Ag.) Thesis*, UAS, Dharwad, Karnataka; c2000.
39. Meshram N, Badge S, Bhongle SA, Khiratkar SD. Effect of bio inoculants with graded doses of NPK on flowering, yield attributes and economics of annual Chrysanthemum. J Soils and Crops. 2008;18(1):217-220.
40. Metzer JD, Atiyeh RM, Edwads CA, Subler S. Earthworm processed organic waste as components of horticulture potting media for growing marigold and vegetable seedlings. Compost Sci. and Utilization. 2000;8:215-223.
41. 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. of Hort. 2010;5(2):347-349.
42. Narasimha S, Haripriya K. Integrated nutrient management in crossandra (*Crossandra infundibuliformis* L.) cv. Dindigul local. South Indian Hort. 2001;49:181-184.
43. Narayana Gowda JV, Srinivasa KNJV. Effect of different organic manures on growth and flower yield of China aster (*Callistephus chinensis* (L.) Nees.). Crop Res. 1999;18:104-107.
44. Nalawadi UG. Nutritional studies in some varieties of marigold (*Tagetes erecta*. L.). Ph. D. Thesis, Univ. Agric. Sci., Bangalore (India); c1982.
45. Narsimha Raju S, Haripriya K. Integrated nutrient management in cossandra (*Crossandra infundibuliformis* L.) Cv. Dindigul local. South Indian Hortic. 2001;49:318-322.
46. Nawghare PD, Gharat SN, Rohidas SB, Patil MB. Impact of organic and inorganic fertilizers on yield and quality parameters of China aster flower var. California giant. J. Maha. Agrc. Univ. 2008;33(1):103-104.
47. Neelima P, Barad AV, Nilima B, Thumar BV. Influence of integrated plant nutrition on growth and flower yield of chrysanthemum (*Chrysanthemum morifolium* Ramat.)cv. IIHR-6 under Saurashtra condition. Asian J. Hort. 2013:8(2):502-506.
48. Panse VG, Sukhatme BV. Statistical Method for Agricultural Workers, IInd. Ed., Indian Council of Agricultural Research, New Delhi; c1985.
49. Patel VS, Malam VR, Nurbhanej KH, Vihol AN, Chavada JR. Effect of organic manures and bio fertilizers on growth, flowering and flower yield of rose (*Rosa hybrid* L.) cv. Gladiator International Journal of Chemical Studies. 2017;5(5):1924-1927.
50. Patil VS, Chaitra R. Integrated nutrient management studies in China aster (*Callistephu schinensis* Nees) cv. Kamini. Karnataka J Ag. Sci. 2007;20(3):689-690.
51. Radha DK, Nethra NN, Jayaprasad KV. China aster (*Callistephus chiensis* (L.) Nees) cultivation using vermicompost as organic amendment. Crop Res. 1999;17(2):209-215.
52. Radhika M, 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 Journal of Horticulture. 2010;5(2):347-349.
53. Rahmawati IKA, Endang Sulistyaningsih. The Growth and Flowering of Potted Chrysanthemum (*Chrysanthemum morifolium* Ramat) on Types of Organic Media and Watering Frequent. Ilmu Pertanian (Agricultural Science). 2019;4.2:59-64.
54. Reddy BS, Balaji SK, Patil BC, Divakara A. Influence of vermicompost and *in situ* vermiculture on the quality attributes and saleable yield in China aster. Sci. Hort. 2006;10:217-221.
55. Rongting JI, Gangqiang Dong, Weiming Shiand Ju Min. Effects of Liquid Organic Fertilizers on Plant Growth and Rhizosphere Soil Characteristics of Chrysanthemum. Sustainability, MDPI, Open Access Journal, 2017, 9(5).
56. Sharma BP, Sharma YD, Dilta BS. Studies of NPK nutrition on growth and flowering in chrysanthemum. International Journal of Plant Sciences, Muzaffarnagar, 2006;1(1):32-35.
57. Sindhu SS, Prakash A, Sharma SK, Prakash A. Effect of phosphorous and FYM on NPK content of marigold in chloride dominated soil. Haryana J of Hort. Sci. 2002;31(1 & 2):47-49.
58. Singh A, Singh JN. Effect of bio fertilizers and bio regulators on growth, yield and nutrient status of strawberry cv. Sweet Charlie. Indian J Hort. 2009;66(2):220-224.
59. Singh BP, Kumar D, Singh VN. Effect of integrated nutrient management on growth, flowering behaviour and yield of African marigold (*Tagetes erecta* L.) cv. African Giant Double. J Hort. Sci. 2009;4(2):134-137.
60. Singh SR, Zargar MY, Najar GR, Ishaq MI, Hakeem SA. Effect of integrated nutrient supply on yield, fertility and quality of strawberry under rainfed temperate conditions. J Indian Soc. Soil Sci. 2012;60(1):79-82.
61. Sonawane SP, Dabke DJ, Dabke SB, Dhane SS. Effect of nitrogen, phosphorus and FYM on yield and nutrient uptake by China aster (*Callistephus chinensis* (L.) Ness). J Maha. Agri. Univ. 2009;34(1):90-91.
62. Sriramachandrasekharan MV, Haripriya K. Effect of organic amendments on the growth and yield of chrysanthemum. J of Ecology. 2002;14(1):39-42.
63. Sunitha HM Hunje. Effect of plant spacing and integrated nutrient management on yield and quality of seed and vegetative growth parameters in African marigold (*Tagetes erecta* L.). J Orn. Hort. 2010;10(4):245-249.
64. Syamal MM, Dixit SK, Sanjay Kumar. Effect of bio-fertilizers on growth and yield in marigold. Journal of Ornamental Horticulture. 2006;9.4:304-305.
65. Valia RZ, Patel PR, Patel NK, Chaudhari SR. Effect of nitrogen and vermicompost on floral and yield parameters of african marigold. Asian J of Hort. 2011;6(2):478-480.
66. Verma AK, Gupta YG, Dhiman SR, Thakur KS. Influence of Nitrogen and Potassium Levels and Holding Solutions on Postharvest Quality of Chrysanthemum (*Dendranthema grandiflora* Tzvelev.) Cut Flowers. Journal of Ornamental Horticulture. 2007;10(4):222-228.
67. Verma SK, Angadi SG, Patil VS, Mokashi AN, Mathad JC, Mummigatti UV. Growth, yield and quality of chrysanthemum (*Chrysanthemum morifolium* Ramat.) cv. Raja as influenced by integrated nutrient management. Karnataka J Agri. Sci. 2011;24(5):681-683.
68. Wange SS, Patil PL. Effects of bio fertilizers alone and with nitrogen levels on tuberose cv. Single Petaled.

Journal of Soils and Crops. 1994;5(2):97-99.
69. Warade AP, Golliwar VJ, Chopde N, Lanje PW, Thakre SA. Effect of organic manures and bio fertilizers on growth, flowering and yield of dahlia. J Soils and Crops. 2007;17(2):354-355.
70. Zargar MY, Baba ZA, Sofi PA. Effect of NP and bio fertilizers on yield and physico-chemical attributes of strawberry. Agro Thesis. 2008;6(1):3-8.
71. Zarghami Moghadam Mina, SHOOR Mahmud. Effects of Vermi-compost and Two Bacterial Bio-fertilizers on some Quality Parameters of Petunia. Notulae Scientia Biologicae; c2013. 5. 10.15835/nsb.5.2.8305.