Int.J.Curr.Microbiol.App.Sci (2018) *7*(4): 1821-1827

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 04 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.704.206

Enhanced Flower Yield and Quality Attributes of Chrysanthemum (*Dendranthema grandiflora* Tzvelev) Inoculated with Phosphorus Solubilizing and Mobilizing Bioinoculants at Different Levels of Phosphorus

Harish, S. Doddujjappalavar[1*], B. Hemla Naik[2], S.Y. Chandrashekar[1], M.S. Nandeesh[1] and Y. Kantharaj[1]

[1]*Department of Floriculture & Landscape Architecture, College of Horticulture, Mudigere-577132, India*
[2]*University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India*

**Corresponding author*

Keywords

Chrysanthemum, Bioinoculants, Phosphorous solubilizing bacteria (*Pseudomonas striata*), Phosphorous solubilizing fungus (*Asperigillus awamori*), Recommended Dose of Phosphorus (RDP).

Article Info

Accepted:
16 March 2018
Available Online:
10 April 2018

A B S T R A C T

A field experiment was conducted to know the effect of phosphorus solubilizing and mobilizing bioinoculants on flower yield and quality attributes of chrysanthemum (*Dendranthema grandiflora* Tzvelev) at the, College of Horticulture, Mudigere during 2016-17. Plants treated with (T_{11}) 75 per cent RDP + PSF + PSB recorded significantly maximum flowers per plant (70.83), flower yield per plant (318.00 g), flower yield per plot (10.74 kg), flower yield per hectare (18.08 t) and individual flower weight (6.30 g), flower diameter (6.23 cm), number of petals per flower (118.37), shelf life (7.00 days), vase life (13.87 days). The lowest values for all the above parameters were recorded with RDF alone.

Introduction

Chrysanthemum (*Dendranthema grandiflora* Tzvelev) commonly known as Gul-e-Daudi or '*Glory of the East*' belongs to the family Compositae (Asteraceae) and it is commonly called as "*Queen of east*". Chrysanthemum is mainly grown for its cut flower for making bouquets, garlands, veni and for decoration during religious and social functions. Nutrition plays an important role for growth, yield and higher quality of chrysanthemum flowers. The increasing costs of fertilizers prevent their use by poor farmers (Adhikary and Gantayet, 2012). Therefore, nowadays attention is shifted towards the alternate sources i.e., use of bioinoculants. The role of bioinoculants to make the soil healthy as well as make unavailable form of soil nutrients to available form by enhancing mineralization and solubilization process, decomposition of plant residues, stimulating plant growth and development. In soil by adding and microbial agents make easy uptake of nutrients when

crop required comparing to chemical fertilizers (Vanilarasu and Balakrishnamurthy, 2014). The present study was undertaken to investigate the effect of phosphorus solubilizing and mobilizing bioinoculants on flower yield and quality attributes of chrysanthemum (*Dendranthema grandiflora* Tzvelev) and also to improve the performance of chrysanthemum and to minimize fertilizer usage.

Materials and Methods

The present investigation was carried out during 2016-17 at College of Horticulture, Mudigere, Chikkamagaluru, Karnataka. Rooted terminal cuttings of chrysanthemum *var*. Marigold used for planting on ridges and furrows in plot size of 3m x 2m with spacing 45 x 45cm (30 plants/plot). The experiment was laid out in a Randomized Block Design (RCBD) with three replications. There were Twelve treatments which were applied as., T_1 - Control (RDF); T_2 - 75 % RDP; T_3 - 50 % RDP; T_4 - 100 % RDP + PSF; T_5 - 75 % RDP + PSF; T_6 - 50 % RDP + PSF; T_7 - 100 % RDP + PSB; T_8 - 75 % RDP + PSB; T_9 - 50 % RDP + PSB; T_{10} - 100 % RDP + PSF + PSB; T_{11} - 75 % RDP + PSF + PSB; T_{12} - 50 % RDP + PSF + PSB.

At the time of transplanting the rooted cuttings were dipped in bioinoculant solution according to treatments and after 30 days after planting (DAP) bioinoculants were applied, and the observations on growth and flower yield parameters were recorded from the tagged plants and the data were analyzed scientifically and interpreted the results and discussed as below.

Results and Discussion

The application of 75 per cent phosphorous with combination of bioinoculant treatments had a significant effect on number of flowers per flower (70.83), flower yield per plant (318.00 g), flower yield per plot (10.74 kg), flower yield per hectare (18.08 t). However, T_1 with un-inoculated control (RDF) recorded minimum alone (Table 1). The other treatments were also found statistically significant over the control for all the parameters. The possible reason for better performance of yield attributes and higher yield could be due to the better physical condition of soil and increased population of microflora, thereby enhanced availability of nutrients through solubilization and mobilization process. Moreover, biofertilizers produce the growth stimulating substances *viz*., auxin, gibberellins and cytokinins which contribute towards vigorous growth of the plant and subsequently higher number of flowers per plant and higher flower yield per hectare. This in turn increases photosynthesis and enhances food accumulation and also diversion of photosynthates towards sink resulting in better quality flowers.

And the difference in yield components could be attributed to the physiological characters, both in vegetative and reproductive phases of crop growth. Difference in dry matter production and its distribution into different plant parts (leaf, stem and flower) with the inoculation of bioinoculants were mainly responsible for the increased in flower yield, number of flowers and flower size. The results are in agreement with the earlier findings of Swaroop (2011) also confirms these findings in marigold, Kirar *et al.,* (2014) in China aster.

The treatment (T_{11}) 75 per cent RDP + PSF + PSB showed the highest individual flower weight (6.30 g), flower diameter (6.23 cm), number of petals per flower (118.37). However, T_1 with un-inoculated control (RDF) recorded minimum (Table 2). The other treatments were also found statistically significant over the control for all the parameters.

Table.1 Effect of phosphorus solubilizing and mobilizing bioinoculants with graded levels of phosphorus on flower yield parameters of chrysanthemum

Treatments		No. of flowers/ plant	Flower yield/ plant (g)	Flower yield (kg/plot)	Flower yield (t/ha)
T_1	RDF (Control)	48.00	235.00	7.71	12.00
T_2	75 % RDP	57.50	284.33	8.53	14.22
T_3	50 % RDP	51.00	269.00	8.15	13.30
T_4	100 % RDP + PSF	58.17	290.00	8.77	14.62
T_5	75 % RDP + PSF	59.23	292.67	8.70	14.50
T_6	50 % RDP + PSF	57.33	288.00	8.64	14.33
T_7	100 % RDP + PSB	68.52	309.33	9.90	15.83
T_8	75 % RDP + PSB	60.17	300.00	8.99	14.28
T_9	50 % RDP + PSB	58.33	294.00	8.82	14.53
T_{10}	100 % RDP + PSF + PSB	67.50	311.33	10.25	17.08
T_{11}	75 % RDP + PSF + PSB	70.83	318.00	10.74	18.08
T_{12}	50 % RDP + PSF + PSB	58.83	299.33	9.00	15.33
SEm ±		1.23	5.61	0.20	0.87
CD (P=0.05)		3.61	16.46	0.58	2.56

Note:
*N and K constant as per the RDF and vesicular arbuscular mycorrhiza (*Glomus fasciculatum*) applied commonly for all treatments
*RDF - Recommended dose of fertilizers
*RDP - Recommended dose of phosphorus
*PSF - Phosphorus solubilizing fungus (*Aspergillus awamori*)
*PSB - Phosphorus Solubilizing Bacteria (*Pseudomonas striata*)

Table.2 Effect of phosphorus solubilizing and mobilizing bioinoculants with graded levels of phosphorus on flower quality parameters of chrysanthemum

Treatment		Flower weight (g/flower)	Flower diameter (cm)	Number of petals per flower
T_1	RDF (Control)	4.13	3.57	81.67
T_2	75 % RDP	4.53	4.00	88.93
T_3	50 % RDP	4.27	3.80	85.13
T_4	100 % RDP + PSF	4.80	4.83	94.67
T_5	75 % RDP + PSF	5.27	5.07	98.00
T_6	50 % RDP + PSF	5.00	4.33	91.97
T_7	100 % RDP + PSB	5.80	5.63	108.80
T_8	75 % RDP + PSB	5.60	5.23	105.30
T_9	50 % RDP + PSB	5.33	4.57	97.30
T_{10}	100 % RDP + PSF + PSB	5.87	5.83	111.33
T_{11}	75 % RDP + PSF + PSB	6.30	6.23	118.37
T_{12}	50 % RDP + PSF + PSB	5.13	4.40	98.57
S. Em ±		0.20	0.17	2.76
C. D. @ 0.05		0.60	0.51	8.10

Note:
*N and K constant as per the RDF and vesicular arbuscular mycorrhiza (*Glomus fasciculatum*) applied commonly for all treatments
*RDF - Recommended dose of fertilizers
*RDP - Recommended dose of phosphorus
*PSF - Phosphorus solubilizing fungus (*Aspergillus awamori*)
*PSB - Phosphorus solubilizing bacteria (*Pseudomonas striata*)

Table.3 Effect of phosphorus solubilizing and mobilizing bioinoculants with graded levels of phosphorus on flower shelf and vase life of chrysanthemum

Treatments		Shelf life (Days)	Vase life (Days)
T_1	RDF (Control)	2.77	7.70
T_2	75 % RDP	3.67	9.00
T_3	50 % RDP	3.17	8.47
T_4	100 % RDP + PSF	4.17	9.60
T_5	75 % RDP + PSF	4.33	10.30
T_6	50 % RDP + PSF	4.20	9.23
T_7	100 % RDP + PSB	5.00	11.97
T_8	75 % RDP + PSB	4.37	10.23
T_9	50 % RDP + PSB	4.17	8.73
T_{10}	100 % RDP + PSF + PSB	6.20	12.33
T_{11}	75 % RDP + PSF + PSB	7.00	13.87
T_{12}	50 % RDP + PSF + PSB	4.37	9.37
S. Em ±		0.69	0.34
C. D. @ 0.05		2.01	0.97

Note:
*N and K constant as per the RDF and vesicular arbuscular mycorrhiza (*Glomus fasciculatum*) applied commonly for all treatments
*RDF - Recommended dose of fertilizers
*RDP - Recommended dose of phosphorus
*PSF - Phosphorus solubilizing fungus (*Aspergillus awamori*)
*PSB - Phosphorus solubilizing bacteria (*Pseudomonas striata*)

Maximum individual flower weight might be due to the significant increase in average flower weight may be due to higher phosphorus availability through PSB and RDF (Laishram *et al.,* 2013). Maximum flower diameter may be assigned to early breaking of apical dominance followed by easy and better translocation of nutrients to the flowers brought about by inoculation with beneficial microbial inoculants like PSF and PSB. Phosphate in soil which helps the plant in healthy growing condition resulting into the production of flower having more diameter. PSB might have helped in increasing phosphorus availability by solubilizing fixed phosphorus in soil and making it available to plant and release the enzymes resulting in the production of larger flowers (Kumar *et al.,* 2006 in marigold).

Similar results are reported by Warade *et al.*, (2007) in dahlia, Pravina *et al.,* (2007) in marigold. The increase in number of florets per flower it might be due to the combined beneficial effect of organic manures, biofertilizers and RDP. Similar results are reported by Verma *et al.*, (2011) and Laishram *et al.,* (2013) in chrysanthemum.

The treatment (T_{11}) 75 per cent RDP + PSF + PSB showed the maximum shelf life (7.00 days) and vase life (13.87 days). However, T_1 with un-inoculated control (RDF) recorded minimum (Table 3). The other treatments were also found statistically significant over the control for all the parameters. It may be due to higher retention of water in the cells of flowers and flower desiccation as caused due to the beneficial effect of bio fertilizer like PSB and FYM (Kumar *et al.,* 2009). It might also be due to the presence of ethylene inhibitors or due to the presence of cytokinins which delay senescence of flowers. These findings are matching with those of Mashaldi (2000) in marigold 2011 and Palagani *et al.*, 2013 in chrysanthemum.

References

Adhikary, S. P. and Gantayet, P. K., 2012. Studies on the influence of organic fertilizers on the growth and some biochemical parameters of chilli (*Capsicum annum* L. Var). *The Bioscan*, 7(2): 255-258.

Kirar K. P. S, Lekhi R, Sharma S, Sharma R., 2014. Effect of integrated nutrient management practices on growth and flower yield of China aster [*Callistephus chinensis* (L.) Ness] cv. Princess. Excellent Publishing House, pp. 234-237.

Kumar, D., Singh, B. P. and Singh, V. N., 2009. Effect of integrated nutrient management on growth, flowering behavior and yield of african marigold (*Tagetes erecta* L.) cv. African Giant Double Orange. *J. Hort. Sci*., 4(2): 134-137.

Kumar, M., Singh, S., Sharma, S. K., Dahiya, D. S. and Beniwal, L. S., 2006. Effect of biofertilizers on growth and flowering of marigold cv. Pusa Narangi. *Haryana J. Hort. Sci*., 35(1&2): 71-72.

Laishram, N., 2013. Studies on integrated nutrient management for commercial flower production of chrysanthemum (*Dendranthema grandiflora* Tzvelev.). *M. Sc. (Agri.) thesis.* Y. S. P. Univ. Hort. and For., Nauni, Solan.

Mashaldi, A., 2000. Effect of organic and inorganic fertilizers on growth, yield and post-harvest life of marigold (*Tagetes erecta* L.) cv. Double orange. *M. Sc. (Agri.) thesis,* Univ. Agri. Sci., Dharwad (Karnataka).

Palagani, N., Barad, A. V., Bhosale, N. and Thumar, B. V., 2013. Influence of integrated plant nutrition on growth and flower yield of chrysanthemum (*Chrysanthemum morifolium* Ramat.) cv. IIHR-6 under saurashtra condition. *Asian J. Hort*., 8(2): 502-506.

Pravina, T., Damke, M. M., Gonge, V. S. and Deshmukh, S., 2007. Influence of integrated nutrient management on vegetative growth parameters of marigold (*Tagetes erecta* L.). *Asian J. Hort*., 2(2): 33-36.

Swaroop, K., 2011. Influence of biofertilizers on growth and productivity of flower and seed yield of Marigold cv. Pusa Narangi Gainda. *J. Orn. Hort.*, 14(3&4): 45-48.

Vanilarasu, K. and Balakrishnamurthy, G., 2014. Influences of organic manures and amendments in soil physiochemical properties and their impact on growth, yield and nutrient uptake of banana. *The Bioscan*, 9(2): 525-529.

Verma, S. K., Angadi, S. G., Patil, V. S., Mokashi, A. N., Mathad, J. C. and Mummigatti, U. V., 2011. Growth, yield and quality of chrysanthemum (*Chrysanthemum morifolium* Ramat.) cv. Raja as influenced by integrated nutrient management. *Karnataka J. Agric. Sci*., 24(5): 681-683.

Warade, A. P., Golliwar, V. J., Chopde, N., Lanje, P. W. and Thakre, S. A., 2007. Effect of organic manures and biofertilizers on growth, flowering and yield of dahlia. *J. Soils and Crops.*, 17(2): 354-357.

How to cite this article:

Harish, S. Doddujjappalavar, B. Hemla Naik, S.Y. Chandrashekar, M.S. Nandeesh and Kantharaj, Y. 2018. Enhanced Flower Yield and Quality Attributes of Chrysanthemum (*Dendranthema grandiflora* Tzvelev) Inoculated with Phosphorus Solubilizing and Mobilizing Bioinoculants at Different Levels of Phosphorus. *Int.J.Curr.Microbiol.App.Sci.* 7(04): 1821-1827. doi: https://doi.org/10.20546/ijcmas.2018.704.206