Int.J.Curr.Microbiol.App.Sci (2020) *9*(2): 577-583

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 9 Number 2 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.902.072

Effect of Integrated Nutrient Management on Growth, Flowering and Yield Parameters in Annual *Chrysanthemum* [*Glebionis coronaria* (L.) Spach]

Anjali Chandel*, Y.C. Gupta and Suman Bhatia

Department of Floriculture and Landscape Architecture, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan 173230, Himachal Pradesh, India

**Corresponding author*

Keywords

Annual chrysanthemum, Biofertilizers, Phosphate Solubilizing Bacteria, Cost Benefit Ratio

Article Info

Accepted:
08 January 2020
Available Online:
10 February 2020

A B S T R A C T

Two strains of annual chrysanthemum [*Glebionis coronaria* (L.) Spach] viz. GC-W (White) and GC-Y (Yellow), as part of their proposed INM schedule were applied with certain organic (Biofertilizers, Jeevamrit) and inorganic fertilizers (NPK) in various combinations. Same observations on various growth and flowering and yield parameters were recorded both the strains in two successive years. Results revealed that growth parameters such as maximum plant height (95.31 cm), plant spread (45.19 cm), flowering parameters such as minimum number of days taken for first flower opening (95.01 days), maximum number of flowers per plant (170.50), individual flower weight (2.30 g), duration of flowering (54.97 days) and yield parameters such as maximum flower yield per plant (490.80 g) were recorded in the plants receiving the treatment of *Azotobacter*, Phosphate Solubilizing Bacteria (PSB) and 75% recommended dose of fertilizers (20 g N and 10 g P_2O_5 / m^2). Whereas maximum flower size at the time of peak flowering (5.91 cm), was found in the plants supplied with *Azotobacter*, PSB and 50% RDF. The observed cost benefit ratio in both the strains ranged from 1.92 (GC-W) to 2.00 (GC-Y).

Introduction

Annual chrysanthemum (*Glebionis coronaria* (L.) Spach) is a popular winter season annual. It was formerly known as *Chrysanthemum coronarium* L. (Le Floc'H*et al*., 2010). It is relatively shorter in duration; photo insensitive and capable of coming throughout the year as compared to florist chrysanthemum. It bears yellow or white coloured flowers with single, double or semi double forms. The flowers assume economic importance on account of their varied uses such as in landscaping, cut flower for vase decorations, garland making, hair adornments and for decorations during religious and social functions.

Annual chrysanthemum generally prefers well drained sandy loam soil with coarse texture

and aeration with pH of 5.5 to 6.5. The quality of flowers is greatly influenced by the quantity and sources of nutrients. Application of 200 kg N and 100 kg P_2O_5/ha was found to be optimum for obtaining higher yield of better quality flowers (Satar *et al*., 2010). Though nitrogen and phosphorus greatly influence the production and quality of flowers, the fertilizers recommendation is generally very high, which reflects directly on cost of production. Due to increased nutritional requirements of crops over course of time it has become impossible to meet the nutritional requirement of the crops, exclusively through the organic farming. Under these circumstances, integrated soil fertility management practices involving judicious combination of organic manures, bio-fertilizers and chemical fertilizers seems to be a feasible option for sustained agriculture on a commercial and profitable scale. Various studies have been carried out previously to work out the effects integrated application of biofertilizers and inorganic fertilizers on growth, flowering and yield parameters. *Azospirillum* and PSB along with 50% vermicompost equivalent to RDN +50% recommended NPK when applied in garland chrysanthemum (*Glebionis coronaria* (L.) Spach), resulted in plants with more height, number of branches per plant, plant spread, early flower bud initiation, + flower diameter, shelf life of loose flower and highest net income and benefit cost ratios in open condition as compared to control (Airadevi, 2012). Progressive increase in seed yield and quality parameters was observed in *Calendula officinalis* by the application of 75% NPK + phosphate solubilizing bacteria (PSB)+ potash mobilizing bacteria (Bappitodu *et al*., 2016). Use of bio-fertilizers in conjugation with chemical fertilizers not only enhances the efficiency of chemical fertilizers but also partly supply nutrients, at the same time improves the soil physical, chemical and biological properties. Use of different sources of nutrients in an integrated manner helps to produce sustainable yields with good quality flowers. Very few attempts have been made so far to study the efficiency of integrated nutrient management in flower crops particularly in annual chrysanthemum.

Materials and Methods

The experiment was conducted at the Experimental farm of the Department of Floriculture and Landscape Architecture of Dr.Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (HP) from November 2016-17 and at the same time during subsequent year (2017-18) under open field conditions. The experimental area fell under the mid hill zone of Himachal Pradesh with sub-Temperate climate characterized by mild summers and cool winters. In the first year of experiment i.e. 2016-17 average maximum/minimum temperature of 22.8˚C/6.8˚C, RH 48 % and rainfall of 38.23 mm was recorded whereas, in year 2017-18 average maximum/minimum temperature was 22.2˚C/6.5˚C, RH 51 % and rainfall was 24.50 mm. Thus, indicating that weather conditions were approximately similar in both the years. Soil pH and EC of experimental site were in normal range whereas, organic carbon percentage was high. Macronutrients such as phosphorus (P) and potassium (K) were higher range whereas nitrogen (N) was in medium range. Farm yard manure (FYM) @ 5kg/ m^2 along with full dose of phosphorus and half dose of nitrogen were applied as per the proposed treatments. Remaining half dose of nitrogen was applied in two splits, 30 days after first application. Two strains of annual chrysanthemum, viz. GC-W (*Glebionis coronaria* -White) and GC-Y (*Glebionis coronaria* - Yellow) were used for conducting present study. One month old seedlings (4-5 healthy leaves) were transplanted in raised beds of size 1x1m^2. There were total nine treatments [T_1-100% RDF (43.47 g Urea and

62.5 g SSP/m^2), T_2- *Azotobacter*+PSB+75% RDF, T_3- *Azotobacter*+PSB+50% RDF, T_4- *Azotobacter*+ AM +75% RDF, T_5- *Azotobacter* +AM+50%RDF, T_6- PGPR+75% RDF, T_7- PGPR+50% RDF, T_8-Jeevamrit, T_9-Control]. Each treatment was replicated thrice. A combined solution of *Azotobacter* and PSB was prepared by adding 100 g each of *Azotobacter* and PSB in water and roots of the seedlings to be transplanted were dipped in the solution for about 30 minutes. Arbuscular Mychorrizae was added @2g/plant near the root zone followed by gentle hoeing for better incorporation. PGPR was applied @5ml/plant after dilution. Soil application of Jeevamrit (5% concentration @ 200ml/ plant) was done in monthly intervals. Jeevamrit was prepared by properly incorporating fresh cow dung (10 kg), pulse flour (1kg), jaggery (1kg), cow urine (5 liters), water (200 liters), forest soil (a handful) in a covered container and kept in shade. The mixture was stirred regularly for 2-4 times. Basic cultural operations such as weeding, hoeing and pinching etc. were performed as and when required. Observations on all the agronomic parameters like plant growth, flowering and yield parameters were recorded and subjected to statistical analysis using MS-Excel and OPSTAT packages to find out the significance of the results obtained. The data recorded under field conditions was subjected to statistical analysis using MS-Excel and OPSTAT packages using randomized block design (RBD) described by Gomez and Gomez (1984).

Results and Discussion

Effect of INM on growth parameters

All the growth parameters were influenced significantly due to various treatments of integrated nutrient management during both experimental years (Table 1). The plants exhibited significant increase in plant height and spread upon treatment with various organic and inorganic fertilizers in comparison to control. Results clearly indicated that a combined application of *Azotobacter*, PSB (Phosphate solubilizing bacteria) and 75% recommended dose of fertilizers (43.47 g Urea and 62.5 g SSP/m^2) proved to be beneficial in improving plant height and spread in the year 2016-17 with average maximum plant height of 95.09 cm in GC-W strain and 93.07 cm in GC-Y strain whereas maximum plant spread of 47.00 cm in GC-W and 38.93 cm in GC-Y strain was recorded. Strain GC-W exhibited more plant height and plant spread of 88.44 cm and 44.23 cm respectively. Same trend in terms of plant height and spread has been followed in the year 2017-18 (97.40 cm and 95.67 cm plant height and 48.33 and 46.51 plant spread in GC-W and GC-Y, respectively)

These findings were in accordance with the results of Patil and Agasimani (2013), Kirar *et al.*, (2014) in China aster and in chrysanthemum; and Airadevi (2012) and Panchal *et al.*, (2010) in annual chrysanthemum.

Effect of Integrated Nutrient Management on flowering parameters

Respective flowering parameters under study were notably affected by integrated nutrient management in the year 2016-17 as well as in 2017-18(Table 2a and 2b).

Results clearly indicated that a combined application of *Azotobacter*, PSB (Phosphate solubilizing bacteria) and 75% recommended dose of fertilizers (43.47 g Urea and 62.5 g SSP/m^2) proved to be beneficial in improving most of the flowering parameters. Approximately same kind of trend has been observed in both the years.

In the year 2016-17, minimum number of days for first flower opening (94.67 days in GC-W strain and 93.33 days in GC-Y strain) and maximum individual flower weight(2.63 g in GC-W strain and 3.18 g in GC-Y strain) was recorded with the application *Azotobacter* +PSB + 75% RDF. Strain GC-Y took lesser number of days for the opening of first flower which was 95.30 days and exhibited more individual flower weight of 3.03 g.

In next year, same drift in case of number of days for first flower opening and individual flower weight has been witnessed upon application of said treatment in both the strains (96.83 and 95.20 days for first flower opening and 2.55 g and 3.52 g of individual flower weight in GC-W and GC-Y strain, respectively).

Table.1 Effect of INM on plant growth of annual *Chrysanthemum* (*Glebionis coronaria* (L.) Spach)

	Plant height				**Plant spread**			
Treatments	**Year 2016-17**		**Year 2017-18**		**Year 2016-17**		**Year 2017-18**	
	GC-W	**GC-Y**	**GC-W**	**GC-Y**	**GC-W**	**GC-Y**	**GC-W**	**GC-Y**
T_1(T_1-100% RDF)	92.03	91.58	94.03	92.33	45.87	36.67	47.39	42.11
T_2(*Azotobacter*+PSB+75% RDF)	**95.09**	**93.07**	**97.4**	**95.67**	**47**	**38.93**	**48.33**	**46.51**
T_3 $_9$*Azotobacter*+PSB+50% RDF0	94.05	92.67	97.27	94.57	46.4	37.2	47.44	42.95
T_4(*Azotobacter*+ AM +75% RDF)	92.82	90.58	94	92.33	43.93	35.97	48.17	41.5
T_5(*Azotobacter* +AM+50%RDF)	90.9	89.25	92.41	89.67	46.5	38.17	41.89	46.33
T_6(PGPR+75% RDF)	86.12	85.72	86.39	85.94	42.67	35.73	43.78	40.7
T_7(PGPR+50% RDF)	83.65	83.37	85.19	78.57	43.67	35.93	43.77	41.47
T_8(Jeevamrit)	81.01	77	82.35	73.67	41.13	33.57	39.19	39.67
T_9(Control)	80.25	74.67	82.2	71	40.87	33.47	38.85	37.8
Mean	**88.44**	**86.43**	**90.14**	**85.86**	**44.23**	**36.18**	**44.37**	**42.14**
C.D. $_{0.05}$	Strains (S)=0.55		Strains (S) =0.57		Strains(S)=0.39		Strains (S) = 0.60	
	Treatments(T)=1.16		Treatments(T)= 1.2		Treatment(T)= 0.83		Treatment (T) = 1.27	
	S x T = 1.64		S x T = 1.67		S x T = NS		S x T = 1.80	

NS= No significant at $CD_{0.05}$
GC-Y= *Glebioniscoronaria*- Yellow
GC-W= *Glebioniscoronaria*- White

Table.2a Effect of integrated nutrient management on flowering parameters of annual chrysanthemum (*Glebionis coronaria* (L.) Spach)

Treatments	Number of days taken for first flower opening				Individual flower weight (g)				Size of fully opened flower			
	Year 2016-17		Year 2017-18		Year 2016-17		Year 2017-18		Year 2016-17		Year 2017-18	
	GC-W	GC-Y	GC-W	GC-Y	GC-W	GC-Y	GC-W	GC-Y	GC-W	GC-Y	GC-W	GC-Y
T_1	98.67	95.67	101.43	98.80	2.50	3.09	2.36	3.04	5.30	5.73	2.36	3.04
T_2	**94.67**	**93.33**	**96.83**	**95.20**	**2.63**	**3.18**	**2.55**	**3.52**	5.40	6.13	2.55	3.52
T_3	97.33	93.67	99.43	97.30	2.63	3.15	2.49	3.37	**5.50**	**6.40**	**2.49**	**3.37**
T_4	95.33	94.33	98.67	97.13	2.50	3.07	2.21	2.69	5.33	5.83	2.21	2.69
T_5	95.00	94.00	97.60	97.00	2.42	3.06	2.08	2.67	5.33	6.10	2.08	2.67
T_6	98.00	95.67	100.60	97.40	2.47	3.02	2.06	2.62	5.27	5.70	2.06	2.62
T_7	97.50	95.33	99.57	97.20	2.31	2.93	1.99	2.53	5.23	5.60	1.99	2.53
T_8	99.33	96.67	102.30	100.63	2.17	2.88	1.82	2.51	5.23	5.60	1.82	2.51
T_9	99.67	99.00	102.70	100.93	2.18	2.85	1.78	2.37	5.17	5.50	1.78	2.37
Mean	**97.28**	**95.30**	**99.90**	**97.96**	**2.42**	**3.03**	**2.15**	**2.81**	**5.31**	**5.89**	**2.15**	**2.81**
C.D. $_{0.05}$	Strains(S)=0.30 Treatment(T)=0.63 S x T = 0.90		S = 0.61 T=1.30 S x T = NS		S =0.04 T =0.09 S x T= NS		S = 0.10 T = 0.21 S x T= NS		S =0.06 T= 0.13 SxT= 0.18		S = 0.06 T = 0.12 S x T = 0.16	

NS= No significant at $CD_{0.05}$; C-Y= *Glebionis coronaria*- Yellow; GC-W= *Glebionis coronaria*- White

Table.2b Effect of integrated nutrient management on flowering of (*Glebionis coronaria* (L.) Spach)

Treatments	Number of flowers per plant				Duration of flowering			
	Year 2016-17		Year 2017-18		Year 2016-17		Year 2017-18	
	GC-W	GC-Y	GC-W	GC-Y	GC-W	GC-Y	GC-W	GC-Y
T_1	178.00	134.67	189.33	146.00	45.67	41.51	44.19	44.10
T_2	**181.33**	**141.33**	**201.00**	**158.33**	**52.97**	**50.67**	**58.41**	**57.84**
T_3	179.00	138.67	198.33	151.33	51.10	51.04	55.61	53.48
T_4	175.00	127.00	181.00	139.33	53.81	50.67	58.30	56.83
T_5	175.33	130.00	184.00	144.67	48.99	48.63	53.41	53.15
T_6	168.33	124.67	182.33	135.67	45.44	45.37	49.46	48.76
T_7	171.00	125.33	181.00	136.33	46.63	44.15	50.43	50.19
T_8	161.33	117.67	174.67	126.67	40.07	38.68	41.74	40.55
T_9	158.33	113.67	169.33	124.67	40.14	38.81	40.29	40.47
Mean	**171.96**	**128.11**	**184.56**	**140.33**	**47.20**	**45.50**	**50.20**	**49.49**
C.D. 0.05$_{0.05}$	Strains (S) = 0.87 Treatment(T)=1.84 S x T = 2.61		S= 0.81 T= 1.82 S x T =2.58		S = 0.74 T = 1.56 S x T = NS		S = 0.61 T =1.30 S x T = NS	

NS= No significant at $CD_{0.05}$

GC-Y= *Glebionis coronaria*- Yellow; GC-W= *Glebionis coronaria*- White

In the year 2016-17, maximum flower size at the time of peak flowering (5.50 cm in GC-W strain and 6.40 cm in GC-Y strain)was noticed with the application of *Azotobacter*+ PSB +50% RDF. GC-Y strain showed more flower size (5.89 cm) as compared to GC-W (5.31cm). In the subsequent year also same variation in flower size at the time of peak flowering was observed due to the effects of said treatment. (2.49 cm in GC-W and 3.37 cm in GC-Y strain). These findings got support from Kirar *et al.,* (2014), who observed maximum length and width of floral head with an application of 50% NPK + vermicompost + *Azotobacter* + PSB in China aster.

In the year 2016-17, it was observed that maximum number of flowers per plant **(**181.33 in GC-W strain and 141.33 in GC-Y strain**)** and maximum duration of flowering (52.97 days in GC-W strain and 50.67 days in GC-Y strain) was attained by the plants provided with *Azotobacter*+ PSB+75% RDF shown in Table no. 2b. There was more number of flowers per plant in GC-W strain (171.96) in comparison to GC-Y strain (128.11). In the year 2017-18, again maximum number of flowers per plant and duration of flowering was observed with the application of *Azotobacter*+ PSB+75% RDF. (201.00 and 158.33 number of flowers and 58.41 and 57.84 days duration of flowering in GC-W and GC-Y strain, respectively). These results are in conformity with those of Patil and Agasimani (2013) and Kirar *et al.,* (2014) in China aster; Mittal *et al.,* (2010) and Kumar *et al.,* (2009) in African marigold; Meshram *et al.,* (2008) and Panchal *et al.,* (2010) in annual chrysanthemum, who recorded maximum flowering duration with *Azospirillum*+ PSB + 50% vermicompost equivalent to recommended dose of N + 50% NPK.

Cost analysis estimate for loose flower production in both the strains was worked out using the best treatment (*Azotobacter*+ PSB+ 75 % RDF) of both the strains. Outcomes have revealed that GC-Y (Yellow) strain and GC-W (White) strain exhibited cost benefit ratio of 1:2 and 1:1.98 respectively. Thus, indicating that GC-Y strain was better in terms of economics thereby giving more benefit per unit area.

From the present investigation it is concluded that fertilizer treatment encompassing *Azotobacter*, Phosphate solubilizing bacteria and 75% of recommended dose of fertilizers (43.47 g Urea and 62.5 g SSP/m^2), can be stated as best integrated nutrient management schedule for improving most of the parameters of economic importance viz. growth, flowering and yield. As all the parameters were evaluated against control, where no treatment was provided the results thus obtained aptly put forward the importance of incorporating the biofertilizers in conventional nutrient application regime and their role in enhancing the availability of nutrients.

References

Airadevi AP. 2012. Integrated nutrient management studies in garland chrysanthemum (*Chrysanthemum coronarium* L.). *Bioinfolet* 9:430-434.

Bappitodu, Rana DK, Punetha P and Kumar P. 2016. Efficacy of integrated nutrient management on seed yield and quality parameters of *Calendula officinalis*. *The Bioscan* 11:1167-1169.

Gomez LA and Gomez AA. 1984. *Statistical Procedure for Agricultural Research*. John Wiley and Sons, Singapore 680p.

Kirar KPS, Lekhi R, Sharma S and Sharma R. 2014.Effect of integrated nutrient management practices on growth and flower yield of China aster [*Callistephus chinensis* (L.)Ness] cv. 'Princess'. In: *Agriculture: Towards a New Paradigm of Sustainability*, Mishra GC, ed.

Excellent Publishing House, New Delhi. pp.234-237.

Kumar D, Singh BP and Singh VN. 2009. Effect of integrated nutrient management on growth, flowering behaviour and yield of African marigold (*Tagetes erecta* L.) cv. 'African Giant Double Orange'. *Journal of Horticultural Sciences* 4:134-137.

Le Floc'h E, Boulos L, Vela E. 2010. *Catalogue Synonymique Commente´de la Flore de Tunisie*, Ministere de l'Environnementet du Developpement durable, Banque Nationale de Genes (ed). 504p.

Meshram N, Badge S, Bhongle SA and Khiratkar SD. 2008. Effect of bio-inoculants with graded doses of NPK on flowering, yield attributes and economics of annual chrysanthemum. *Journal of Soils and Crops*18:217-220.

Mittal R, Patel HC, Nayee DD and Sitapara HH. 2010. 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*5:347-349.

Palagani N, Barad AV, Bhosale N and Thumar BV. 2013. Influence of integrated plant nutrition on growth and flower yield of chrysanthemum *(Chrysanthemum morifolium* Ramat.) cv. 'IIHR-6'. *The Asian Journal of Horticulture* 8:502-506.

Panchal RV, Parekh NS, Parmar AB and Patel HC. 2010. Effect of biofertilizers and nitrogenous fertilizer on growth, flowering and yield of annual white chrysanthemum (*Chrysanthemum coronarium* L.) under middle Gujarat agroclimatic conditions. *The Asian Journal of Horticulture*5:22-25.

Panchal RV, Parekh NS, Parmar AB and Patel HC. 2010. Effect of biofertilizers and nitrogenous fertilizer on growth, flowering and yield of annual white chrysanthemum (*Chrysanthemum coronarium* L.) under middle Gujarat agroclimatic conditions. *The Asian Journal of Horticulture*5:22-25.

Patil VS and Agasimani AD. 2013. Effect of integrated nutrient management on growth and yield parameters in China aster [*Callistephus chinensis* (L.) Nees]. *Mysore Journal of Agricultural Sciences*47:267-272.

Satar VP, Panchabhai DM, Thakre S and Shivankar S. 2010. Effect of nitrogen and phosphorus level on flower yield and quality of annual chrysanthemum. *The Asian Journal of Horticulture* 7:343-246.

How to cite this article:

Anjali Chandel, Y. C. Gupta and Suman Bhatia. 2020. Effect of Integrated Nutrient Management on Growth, Flowering and Yield Parameters in Annual Chrysanthemum [Glebionis coronaria (L.)Spach]. *Int.J.Curr.Microbiol.App.Sci.* 9(02): 577-583.
doi: https://doi.org/10.20546/ijcmas.2020.902.072