"Impact of bio-fertilizers and inorganic manures on flower yield attributes of China aster (*Callistephuschinensis* L. Nees) cv. Kamini"

Abstract

The impact of bio-fertilizers and inorganic manures on China aster was studied during 2019-2020 at Horticultural Research Farm, Department of floriculture and Landscape Architecture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G) in Rabi period. Treatments comprised of 50, 75 and 100% of the recommended dose in combination with biofertilizers Azotobacter, Vermicompost, PSB and FYMproved to be the most effective in increasing the weight of individual flower (g), flower yield per plant (g), flower yield per plot (kg) and flower yield per hectare (q).

Keywords;FYM, Azotobacter, Vermicompost and China aster.

Introduction

Chinaaster[*Callistephuschinensis*(L).Nees]belongstooneofthelargestfamilie sofflowering plants, 'Asteraceae'. It'sdiploid (2n) chromosome number is 18 (Huziwara, 1954). The genus *Callistephus*has only a single species *Callistephuschinensis*. Linnaeus named it *Asterchinensis* at first, but it was renamed to *Callistephuschinensis* by Nees. The single species chinensis belong to the genus *Callistephus* (Munikrishnappa and Chandrasheker, 2014). The name *Callistephus* is derivative from two Greek words: Kalistos, which means most attractive and Stephus, which means crown. It symbolizes purity, love, peace, beauty and passion (Naikwad*et al.*, 2018).The colours are varied, including natural pink shades of white, pink, primrose, light blue, lavender, fuchsia, purple, dark blue and scarlet. Kamini variety was derived by crossing two pure lines (AST 6 x AST- 36) and was developed through pedigree method of breeding with the intent of obtaining pink coloured flowering variety for cut flower purpose, which is exceptional to the Local Pink variety.

It is native to China has spread to Europe and other tropical countries

Comment [H1]: And

during 1731 A.D. (Desai, 1967). The China aster has become one of the most popular garden flowers. Among the colours present in all of the many variations are pure white, purple, dark blue, numerous shades of pink, pastel blue, and red. Aster does not have a pure golden color. Flower with more petals are ideal for use as loose flowers in garlands, buttonholes and veni for hair ornamentation. Aster flower plants are a popular bedding plant in landscape gardening and use as a pot plant, as well as in a mixed herbaceous border and are ideal for window boxes and edging. The China aster is now widely regarded as one of the most beautiful garden flowers (Kirar *et al.*, 2009 and Kumar *et al.*, 2018).

Comment [H2]: Repetition of sentence

India's overall floriculture area was 313 thousand hectares 2019-20, with a production of 2865 thousand metric tons of cut and loose flower. In Madhya Pradesh, total area under flower cultivation in 2019-20 was 30.80 thousand hectares, with a total production of 363.83 thousand metric tons of loose and cut flowers (NHB 2nd advance estimate 2019-20).

Biofertilizer maintains living cells or latent cells of effective microbial strains. When they are spread through nucleoli or dirt, they help crops absorb nutrients through cooperation in the rhizosphere. They promote the active development of microorganisms in the soil, thereby supplementing the range of nutrient availability in a form that plants can easily adapt. The farthest part of the spreading phosphorus stays still in the soil and quickly transforms into something that plant approval cannot reach. In order to accumulate soil nutrient reserves, we increase chemical fertilizers to satisfy the nutritious food of plants.

Materials and Methods:

The experiment was conducted in the Horticultural Research Farm, Department of Horticulture and landscape architecture, College of Agriculture, IGKV, Raipur, (C.G.) during Rabi season of the year 2019-20. The experiment was conducted on China aster with eleven treatment and three replication in Randomized Block Design. The total number of plant per plot 35 were space at 30 cm x 30 cm.The seeds of China aster cv. Kamini were sown in pro-trays and kept in germination chamber for proper germination.

List 1 :Treatment combinations

S. No.	Treatments	Notations to be used
1.	100% RDF (Control)	T_1
2.	75% RDF + PSB + Azotobacter	T_2
3.	50% RDF + PSB + Azotobacter	T_3
4.	75% RDF + 25% FYM	T_4
5.	50% RDF + 50% FYM	T_5
6.	75% RDF + 25% Vermicompost	T_6
7.	50% RDF + 50% Vermicompost	T_7
8.	75% RDF + 25% FYM + PSB + Azotobacter	T_8
9.	75% RDF + 25% Vermicompost + PSB+ Azotobacter	T_9
10.	50% RDF + 50% Vermicompost + PSB+ Azotobacter	T_{10}
11.	50% RDF + 50% FYM+ PSB + Azotobacter	T_{11}

Result and Discussion:-

Flower weight(g) of individual flower:-

Effect of bio-fertilizers and inorganic manures on the flower weight (g) wasvariedfrom 1.01to1.63 g. Themaximumaverageweightofflower(1.63 g)wasfoundinTreatment T_9 (75% RDF + 25% Vermicompost + PSB+ *Azotobacter*) which was found at par with treatment T_{10} (50% RDF + 50% Vermicompost + PSB+ *Azotobacter*). However it was showed significantly differ with rest of other treatments. The minimum averageweightofflowerwas(1.01 g) observed with TreatmentT_1 control (100% RDF). *Azotobacter* and phosphorous solubilizing bacteria supplied available plant nutrients direct to the plant and similarly solubilizing outcome on stable usage of plant nutritious in the soil provided further nutritious to the plants along with enhanced plant growth furthermore flower yield. The result can be supported by the finding of Agrawal *et al.,* (2002), Panchal *et al.,* (2010) in annual chrysanthemum.

Flower yield per plant (g):-

Flower yield per plant recorded significant variations among the different treatments, the maximum flower yield (39.36g) per plant was obtained in treatment T_9 (75%RDF +25% Vermicompost +PSB + *Azotobacter*) which was exhibited similar result with the treatment T_8 (75% RDF + 25% FYM + PSB +*Azotobacter*). The result showed significant differences with rest of the all other treatments. Similar results were also reported by Gupta *et al*., (1999) in marigold.Fixation of nitrogen and production of growth encouraging materials like indole acetic acid and gibberellins which increase the branches number in each plant. The outcomes are add in with finding of Chaitra and Patil (2007) who reported that maximum flower yield per plant with inoculation of *Azotobacter* and PSB in China Aster.

Flower yield per plot (kg):-

Effect of bio-fertilizers and inorganic manures on flower yield per plotafter analysis the data presented refers that by the applying the different doses of NPK, organic manure and biofertilizer with or without combinations affect the flower yield per plot. The maximum flower yield per plot (1.37 kg) was obtained with treatment T_9 (75% RDF + 25% Vermicompost + PSB+ *Azotobacter*)which was showed *at par* with treatment T_8(75% RDF + 25% FYM + PSB +*Azotobacter)*. However, it was exhibited significant difference with rest other treatments. The minimum yield of flower per plot (0.83 kg) were found in T_1 (100% RDF control).Similar results were also reported by Gupta *et al*., (1999) in marigold.

Comment [H3]: Include results also

Table1:Impact of bio-fertilizers and inorganic manures on flower yield attributes of China aster (*Callistephuschinensis* L. Nees) cv. Kamini

Treatments	Flower weight(g) of individual flower	Flower yield per plant (g)	Flower yield per plot (kg)	Flower yield per hectare(q/ha)
T_1 - 100% RDF (Control)	1.01	23.79	0.83	26.86
T_2 - 75% RDF + PSB + Azotobacter	1.02	26.82	0.94	30.28
T_3 - 50% RDF + PSB + Azotobacter	1.03	26.51	0.92	29.23
T_4 - 75% RDF + 25% FYM	1.05	27.15	0.95	30.65
T_5 -50% RDF + 50% FYM	1.04	26.01	0.91	29.36
T_6 - 75% RDF + 25% Vermicompost	1.07	28.43	1.00	32.10
T_7 - 50% RDF + 50% Vermicompost	1.08	28.30	0.99	31.94
T_8 - 75% RDF + 25% FYM + PSB + Azotobacter	1.16	33.46	1.17	37.44
T_9 -75% RDF + 25% Vermicompost + PSB+ Azotobacter	1.63	39.36	1.37	44.44
T_{10} - 50% RDF + 50% Vermicompost + PSB+ Azotobacter	1.31	32.09	1.12	36.23
T_{11} - 50% RDF + 50% FYM+ PSB + Azotobacter	1.08	28.32	0.99	31.97
SEm±	**0.33**	**2.00**	**0.92**	**2.59**
CD at 5% level	**0.11**	**5.91**	**2.73**	**7.67**

Flower yield per hectare (q/h):-

Theflower yieldwasvariedfrom 26.86 to44.44 q per ha. Themaximumflower yield per ha(44.44 q/ha)wasfoundintreatment T_9 (75% RDF + 25% Vermicompost + PSB+ *Azotobacter*) which was exhibited at par with treatment T_8 (75% RDF + 25% FYM + PSB +*Azotobacter*). However it was showed significantly differ with rest of other treatments. The minimum flower yield per hawas(26.83 q/ha) observed with treatmentT_1 (100% RDF control). Application of vermicompost along with RDF, provided accessible nutrients promptly to the plant and also had solubilizing consequence on immobile form of nutrients in the soil provided supplementary nutrients to the plants as well as amended the physical and biological properties of soil and increase yield. It may also be due to the production of plant hormone by the biofertilizers, which encouraged root development and resulted variations in rhizosphere, which it turns stimulated the absorption of the nutritious. Increase the yield of the flower per plant and per plot as well as per hectare might also be due to probable function of *Azotobacter* and PSB through atmospheric fixation, augmented accessibility of phosphorous and its enhanced absorption, improved root development and absorption of nutritious. These results are accordance in the finding of Sunitha *et al*. (2005)and Kumar *et al.* (2009) in African marigold; Panchal *et al*. (2010) and Verma *et al.* (2011) in annual chrysanthemum.

CONCLUSION :

The results of the present investigation revealed that the nutritional requirement of china aster could be fulfilled with the exclusive use of different bio-fertilizers and inorganic manures on flower yield of china aster. The majority of the flower yield attributes characteristics of weight of individual flower (g), flower yield per plant (g), flower yield per plot (kg) and flower yield per hectare (q) were found to respond best to treatment T_9 - 75% RDF + 25% Vermicompost + PSB+ Azotobacterfollowed by T_8 (75% RDF + 25% FYM + PSB + Azotobacter).

References:

Agrawal, S., Agrawal, N., Dixit, A. and Yadav, R.N. 2002. Effect of N and K_2O on African Marigold in Chhattisgarh region. Journal of ornamental Horticulture New Series. 5(1):86.

Anonymous, 2020. Indian Horticulture Database, http:www.nhb.gov.in

Chaitra, R. and Patil, V.S. 2007. Integrated nutrient management studied in growth, yield and flower quality in China Aster (*Callistephuschinensis* (L) Ness). Karnataka journal of Agriculture Science. 20(3):689-690.

Gupta, N.S., Sadavarte, K.L., Mahorkar, V.K., Jadhav, B.J.andDorak, S.V. 1999. Effect of graded levels of nitrogen and bio inoculants on growth and yield of marigold, Journal of soil crop. 9(1):80-83.

Huziawara, R. 1954. Seasonal flowers, ICAR publications, New Delhi, 2(2): 5-15.

Kirar, K.P.S., Lekhi, R., Sharma, S. and Sharma, R. 2014. Effect of integrated nutrient management practices on growth and flower yield of China Aster (*Callistephuschinensis* (L.) Ness) CV. Princess. In: Agriculture Towersds a New Paradigm of Sustainability, Mishra GC (Ed.) Excellent publishing house, New Delhi. 3(2):234-237.

Kumar, S., Agrawal, N., Dixit, A. and Yadav, R.N. 2009. Effect of N and K_2O on African Marigold in Chhattisgarh region. Journal of ornamental Horticulture New Series. 5(1):86.

Munikrishnappa, V. and Chandrashekhar, S. 2014. Influence of micronutrients on growth, flowering and yield of African marigold (*Tageteserecta* L.) Journal of pharmacognosy and phytochemistny,10(3): 461-463.

Naikwad, D.K., Kandpal, M.G., Patil, A. and Kulkarni, V. 2018. Correlation and Path Analysis in China aster (*Callistephuschinensis* L.). International Journal of Current Microbiology and Applied Sciences, 7(2): 3353-3362.

Panchal, R.V., Parekh, N.S., Parmar, A.B. and Patel, H.C. 2010. Effect of biofertilizer and nitrogenous Fertilizer on growth flowering and yield of

annual white chrysanthemum (*Chrysanthemum coronarium* L). Asian Journal of Horticulture. 5(1):22-25.

Patil, V.S., Agasimani, A.D. 2013.Effect of integrated nutrient management on growth and yield parametes in China Aster (*Callistephuschinensis* (L.) Ness). Mysore Journal of Agricultural Science.;47(2):267-277.

Sunitha, H.M., Ravi, Vyakaranatial, B.S. and Ablad, H.B. 2005. Effect of Plant spacing and integrated nutrient management on yield and quality of seed and vegetable growth parameters in African marigold (*Tageteserecta* L.). Journal of ornamental Horticulture. 10(4):245 - 249.

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 Journal of Agricultural Science. 24(5):681 – 683.

Comment [H4]:

Comment [H5]: parameters