

“Impact of bio-fertilizers and inorganic manures on flower yield attributes of China aster (*Callistephus chinensis* 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 bio-fertilizers Azotobacter, Vermicompost, PSB and FYM proved 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

China aster [*Callistephus chinensis* (L.) Nees] belongs to one of the largest families of flowering plants, 'Asteraceae'. It's diploid (2n) chromosome number is 18 (Huziwara, 1954). The genus *Callistephus* has only a single species *Callistephus chinensis*. Linnaeus named it *Aster chinensis* at first, but it was renamed to *Callistephus chinensis* by Nees. The single species *chinensis* belongs 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 [R1]: Mention about the treatments clearly in one sentence and then write about the treatment which outperformed other treatments

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).

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.

Comment [R2]: Conclude introduction in to the objective of your study

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.

Comment [R3]: Write briefly about the statistical analysis of your study, soil of the experimental plot.

Comment [R4]: Plants per plot was 35 which were spaced at

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) was varied from 1.01 to 1.63 g. The maximum average weight of flower (1.63 g) was found in Treatment T₉ (75% RDF + 25% Vermicompost + PSB+ *Azotobacter*) which was found at par with treatment T₁₀ (50% RDF + 50% Vermicompost + PSB+ *Azotobacter*). However it was showed significantly different with from rest of other treatments. The minimum average weight of flower was (1.01 g) observed with Treatment T₁ 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 findings of Agrawal *et al.*, (2002), Panchal *et al.*, (2010) in annual chrysanthemum.

Comment [R5]: Nutrition

Comment [R6]: nutrition

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 T₉ (75% RDF + 25% Vermicompost + PSB + *Azotobacter*) which was exhibited similar result with the treatment T₈ (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.

Comment [R7]: Which exhibited

Comment [R8]: Increased

Comment [R9]: Rewrite the sentence properly

Flower yield per plot (kg):-

Effect of bio-fertilizers and inorganic manures on flower yield per plot after 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 T₉ (75% RDF + 25% Vermicompost + PSB + *Azotobacter*) which was showed *at par* with treatment T₈ (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 T₁ (100% RDF control). Similar results were also reported by Gupta *et al.*, (1999) in marigold.

Comment [R10]: Rewrite the sentence properly

Table1:Impact of bio-fertilizers and inorganic manures on flower yield attributes of China aster (*Callistephus chinensis* 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)
T₁ . 100% RDF (Control)	1.01	23.79	0.83	26.86
T₂ . 75% RDF + PSB + Azotobacter	1.02	26.82	0.94	30.28
T₃ . 50% RDF + PSB + Azotobacter	1.03	26.51	0.92	29.23
T₄ - 75% RDF + 25% FYM	1.05	27.15	0.95	30.65
T₅ .50% RDF + 50% FYM	1.04	26.01	0.91	29.36
T₆ . 75% RDF + 25% Vermicompost	1.07	28.43	1.00	32.10
T₇ . 50% RDF + 50% Vermicompost	1.08	28.30	0.99	31.94
T₈ . 75% RDF + 25% FYM + PSB + Azotobacter	1.16	33.46	1.17	37.44
T₉ .75% RDF + 25% Vermicompost + PSB+ Azotobacter	1.63	39.36	1.37	44.44
T₁₀ . 50% RDF + 50% Vermicompost + PSB+ Azotobacter	1.31	32.09	1.12	36.23
T₁₁ . 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):-

The flower yield was varied from 26.86 to 44.44 q per ha. The maximum flower yield per ha (44.44 q/ha) was found in treatment T₉ (75% RDF + 25% Vermicompost + PSB + *Azotobacter*) which was exhibited at par with treatment T₈ (75% RDF + 25% FYM + PSB + *Azotobacter*). However it was showed significantly differ with rest of other treatments. The minimum flower yield per ha was (26.83 q/ha) observed with treatment T₁ (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.

Comment [R11]: Increase in the

Comment [R12]: Are in accordance with the

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 T₉ - 75% RDF + 25% Vermicompost + PSB + *Azotobacter* followed by T₈ (75% RDF + 25% FYM + PSB + *Azotobacter*).

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