Plant Archives Vol. 16 No. 2, 2016 pp. 594-596 *ISSN 0972-5210*

EFFECT OF ZINC SULPHATE AND FERROUS SULPHATE ON GROWTH AND FLOWERING OF ANNUAL CHRYSANTHEMUM

Neha Chopde, G. H. Borse, Ommala Kuchanwar and A. T. Ghodke

Horticulture Section, College of Agriculture, Amravati Road, Nagpur – 440 010 (Maharashtra), India.

Abstract

The investigation entitled "Effect of zinc sulphate and ferrous sulphate on growth and flowering of annual chrysanthemum" was carried out during *rabi* season of the year 2015-16 at Satpuda Botanic Garden, College of Agriculture, Nagpur (Maharashtra), India with nine treatment combinations in Factorial Randomized Block Design. The treatments comprised of different levels of zinc sulphate and ferrous sulphate (0% *i.e.* water spray, 0.25% and 0.5% each). The results revealed that foliar application of 0.5% zinc sulphate and 0.5% ferrous sulphate recorded significantly maximum vegetative growth in respect of plant height and branches plant^{-1}, yield in respect of number of flowers plant^{-1} and flower yield plant^{-1}, quality in respect of flower diameter and the earliest first flower bud initiation and 50 per cent flowering. However, interaction effect of zinc sulphate and ferrous sulphate on growth, flowering, yield and quality parameters of annual chrysathemum was found to be non-significant.

Key words : Annual chrysanthemum, zinc sulphate, ferrous sulphate, growth, flowering.

Introduction

Annual chrysanthemum (*Chrysanthemum coronarium*), 'Crown Daisy' or 'Garland chrysanthemum' is one of the most important flower crops grown in India. Because of variation in size, shape and colour of flowers, the annual chrysanthemum is popular among the people. The climate of Maharashtra is most suitable to grow this crop with less efforts and expenditure. There is an ample scope to enhance the productivity of annual chrysanthemum by adopting proper crop management techniques. In order to meet the ever increasing demand of production of quality flowers, to increase productivity and to overcome the physiological disorders, application of major and micronutrients are inevitable. Now-a-days, micronutrients especially zinc (zinc sulphate) and iron (ferrous sulphate) are gradually gaining momentum among the flower growers because of their beneficial nutritional support and to ensure better harvest and returns. Keeping this in view, the present study was undertaken to investigate the effect of foliar application of zinc sulphate and ferrous sulphate on growth, yield and quality of annual chrysanthemum.

Materials and Methods

The present investigation was carried out at Satpuda Botanic Garden, College of Agriculture, Nagpur during *rabi* season of the year 2015-16 to study the effect of foliar application of zinc sulphate and ferrous sulphate on growth, yield and quality of annual chrysanthemum genotype 'NAC-7' and find out suitable concentration of both the nutrients for production of higher yield of better quality flowers with nine treatment combinations in Factorial Randomized Block Design with three replications. The treatments comprised of different levels of zinc sulphate and ferrous sulphate (0% *i.e.* water spray, 0.25% and 0.5% each).

The experimental plot was brought to fine tilth by ploughing, clod crushing and harrowing. At the time of land preparation, well rotted FYM @ 15 t ha^{-1} was mixed uniformly in the soil before last harrowing. The field was then laid out with flat beds of the dimension 2.25 × 2.40 m. Uniform and healthy seedlings of genotype NAC-7 of annual chrysanthemum were transplanted in the prepared plots at the spacing of 45 × 30 cm.

Solutions of zinc sulphate and ferrous sulphate each of 0% (water spray), 0.25% and 0.5% were prepared by dissolving respective amount of zinc sulphate and ferrous sulphate, respectively in distilled water. Then the prepared solution was sprayed twice at 20th and 30th day after transplanting of seedlings individually and in combination as per the treatment. The various observations on growth, flowering, yield and quality parameters of annual chrysanthemum were recorded and analysed statistically.

Results and Discussion

The data presented in table 1 revealed that different levels of zinc sulphate and ferrous sulphate had significant effect on all growth, flowering, yield and quality parameters of annual chrysanthemum studied in this experiment except disc diameter of flower.

Growth

Significantly maximum plant height (96.74 cm) and branches plant^{-1} (41.16) in annual chrysanthemum were recorded with foliar application of 0.5% zinc sulphate and it was followed by 0.25% zinc sulphate (91.34 cm and 38.92, respectively). Similarly, foliar spray of 0.5% ferrous sulphate noted significantly the highest plant height (95.93 cm) and branches plant^{-1} (41.99), which was followed by 0.25% ferrous sulphate in respect of plant height (90.19 cm) and found statistically at par with 0.25% ferrous sulphate in respect of branches plant^{-1} (39.47). Whereas, the lowest plant height (82.66 and 84.63 cm) and branches plant^{-1} (37.37 and 35.99) were noticed with control *i.e.* 0% each of zinc sulphate and ferrous sulphate, respectively. An interaction effect of zinc sulphate and ferrous sulphate on plant height and branches plant^{-1} was found to be non-significant.

An increased vegetative growth with foliar spray of 0.5% zinc sulphate and 0.5% ferrous sulphate might be due to the fact that, zinc applied at optimum concentration is closely involved in metabolism of RNA and ribosomal content in plant cell, which leads to stimulation of carbohydrates, proteins and DNA formation. It also helps in synthesis of tryptophan which acts as a growth promoting substance. Similarly, iron applied with proper concentration acts as an important catalyst in the enzymatic reaction of metabolism. This ultimately would have helped in larger biosynthesis of photoassymilates, thereby enhanced vegetative growth of plant. The results could paint in the same direction of Karuppaiah (2014) in chrysanthemum.

Flowering

The foliar treatment of 0.5% zinc sulphate and 0.5 % ferrous sulphate took significantly minimum days for first flower bud initiation (38.65 and 40.22 days, respectively) and 50 per cent flowering (57.32 and 58.33 days, respectively), which were found to be at par with 0.25% zinc sulphate and 0.25% ferrous sulphate, respectively, whereas, the control treatment (water spray) recorded maximum days for first flower bud initiation (43.06 and 43.13 days, respectively) and 50 per cent flowering (61.17 and 61.13 days, respectively). The interaction effect of zinc sulphate and ferrous sulphate on days for first flower bud initiation and 50 per cent flowering in annual chrysanthemum was found to be non-significant.

An early flowering with 0.5% each of zinc sulphate and ferrous sulphate might be due to enhanced growth and development of plant. Zinc favours the storage of more carbohydrates through photosynthesis and iron involves in synthesis of plant harmones and also plays an important role in chlorophyll synthesis, photosynthesis and respiration. This may be the attributing factor for the positive effectiveness of optimum dose of zinc and iron on reducing juvenile phase of the plant. Similar results are also obtained by Balkrishnan *et al*. (2007) in African marigold. They reported that, 0.5% zinc sulphate and 0.5% ferrous sulphate recorded an early flowering.

Flower yield and quality

In this experiment, total number of flowers plant^{-1} in annual chrysanthemum was noticed significantly maximum with the foliar treatments of 0.5% zinc sulphate (85.47) and 0.5% ferrous sulphate (85.21), which were statistically at par with 0.25% zinc sulphate (83.73) and 0.25% ferrous sulphate (84.50), respectively, whereas, the control treatment *i.e.* 0% zinc sulphate (81.60) and 0% ferrous sulphate (81.09) counted significantly lowest number of flowers plant^{-1}. Similarly, foliar spray of 0.5% zinc sulphate and 0.5% ferrous sulphate noted significantly the highest flower yield plant^{-1} (448.25 and 444.18 g, respectively). The treatment of 0.5 % of zinc sulphate was followed by 0.25% zinc sulphate (411.02 g), whereas, 0.5% ferrous sulphate was found statistically at par with 0.25% ferrous sulphate (427.35 g) in respect of flower yield plant^{-1}. However, the lowest flower yield (386.94 and 374.67 g) was noticed with control *i.e.* 0% each of zinc sulphate and ferrous sulphate, respectively. An interaction effect of zinc sulphate and ferrous sulphate on flowers plant^{-1} and flower yield plant^{-1} was found to be non-significant. This might be due to the fact that, zinc activates several enzymes *viz*. catalyase, tryptophan synthate etc. and involves itself in chlorophyll synthesis and various physiological activities by which plant growth and development are encouraged, due to which the flower yield might have been increased. The findings are in agreement with the results obtained by Khalifa *et al*. (2011) in Iris plants. Similarly, iron applied through 0.5% ferrous sulphate enhanced the flowering parameters, relived the plant from chlorosis and produced healthy green leaves which resulted in higher assimilate synthesis and partitioning of flower growth which may in turn have increased the flower production and ultimately yield. Similar results were also reported by Ganga *et al*. (2008) in chrysanthemum.

Table 1 : Growth and flowering of annual chrysanthemum as influenced by foliar application of zinc sulphate and ferrous sulphate.

Treatments	Plant height (cm)	Branches plant^{-1}	Days for first flower bud initiation (days)	Days for 50 per cent flowering (days)	Flowers plant^{-1}	Flower yield plant^{-1} (g)	Flower diameter (cm)	Disc diameter (cm)
Factor A – $ZnSO_4$								
B_1- 0% (Control)	82.66	37.37	43.06	61.17	81.60	386.94	5.70	0.79
B_2- 0.25% $ZnSO_4$	91.34	38.92	40.67	60.67	83.73	411.02	5.84	0.86
B_3- 0.5% $ZnSO_4$	96.74	41.16	38.65	57.32	85.47	448.25	5.95	0.87
SE (m) ±	1.56	0.95	0.76	1.23	0.97	7.51	0.06	0.03
CD at 5%	4.67	2.85	2.29	3.69	2.90	22.52	0.19	-
Factor B – $FeSO_4$								
M_1- 0% (Control)	84.63	35.99	43.13	61.13	81.09	374.67	5.68	0.83
M_2- 0.25% $FeSO_4$	90.19	39.47	41.03	59.69	84.50	427.35	5.86	0.87
M_3- 0.5% $FeSO_4$	95.93	41.99	40.22	58.33	85.21	444.18	5.95	0.82
SE (m) ±	1.56	0.95	0.76	1.23	0.97	7.51	0.06	0.03
CD at 5%	4.67	2.85	2.29	3.69	2.90	22.52	0.19	-
Interaction (AXB)								
SE (m) ±	2.70	1.64	1.32	2.13	1.68	13.02	0.11	0.05
CD at 5%	-	-	-	-	-	-	-	-

In respect of the flower quality parameters in annual chrysanthemum, the foliar treatment of 0.5% zinc sulphate exhibited significantly maximum flower diameter (5.95 cm) which was found statistically at par with 0.25% zinc sulphate (5.84 cm), however, the control treatment i.e. water spray recorded minimum value (5.70 cm). Similarly, significantly maximum flower diameter was recorded with the foliar treatment of 0.5% ferrous sulphate (5.95 cm) and it was statistically at par with 0.25% ferrous sulphate (5.86 cm), whereas, 0% ferrous sulphate recorded minimum diameter of flower (5.68 cm). However, in respect of disc diameter of flower no significant differences observed among different levels of zinc sulphate and ferrous sulphate in annual chrysanthemum. The interaction effect of zinc sulphate and ferrous sulphate on flower diameter and disc diameter in annual chrysanthemum was found to be non-significant. Better quality flowers of annual chrysanthemum were produced due to application of 0.5% zinc sulphate and 0.5% ferrous sulphate which might be due to enhanced vegetative growth resulted into production of more food material which in turn might have been utilized for better development of flowers of annual chrysanthemum. The results are in close conformity with the findings of Lahijie (2012) in gladiolus.

Thus, it can be inferred from the present investigation that, foliar application of 0.5% each of zinc sulphate and ferrous sulphate increased vegetative growth and flower yield, enhanced flowering and improved flower quality in annual chrysanthemum genotype 'NAC-7'.

References

Balkrishnan, V., M. Jawaharlal, T. Senthil Kumar and M. Ganga (2007). Response of micro nutrients on flowering, yield and xanthophyll content in African marigold. *J. Orna. Hort.*, **10(3)** : 153-156.

Ganga, M., V. Jegadeeswari, K. Padmadevi and M. Jawaharlal (2008). Response of chrysanthemum cv. CO.1 to the application of micronutrients. *J. Orna. Hort.*, **11(3)** : 220-223.

Karuppaiah, P. (2014). Effect of zinc and iron on growth, yield and quality of chrysanthemum. *The Asian J. Hort.*, **9(1)** : 232-236.

Khalifa, R. K. M., S. H. A. Shaaban and A. Rawia (2011). Effect of foliar application of zinc sulphate and boric acid on growth, yield and chemical constituents of Iris plants. *Ozean J. Applied Sci.*, **4(2)** : 129-144.

Lahijie, M. F. (2012). Application of micronutrients $FeSO_4$ and $ZnSO_4$ on growth and development of gladiolus variety "Oscar". *International J. Agric. Crop Sci.*, **4(1)** : 781-720.