Plant Archives Vol. 18 No. 2, 2018 pp. 1355-1358 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF FOLIAR FEEDING OF ZINC AND IRON ON FLOWERING AND YIELD ATTRIBUTES OF GLADIOLUS (*GLADIOLUS GRANDIFLORUS* L.) CV. NOVALUX

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Abstract

An experiment was carried out to study the effect of foliar feeding of zinc and iron on flowering and yield attributes of Gladiolus (*Gladiolus grandiflorus* L.) cv. Novalux in the year 2015-2016. The experiment was carried out in Randomized Block Design with nine treatments *viz.* $FeSO_4$ 0.25%, $FeSO_4$ 0.5%, $ZnSO_4$ 0.25%, $ZnSO_4$ 0.5%, $FeSO_4$ 0.25%+ $ZnSO_4$ 0.25%, $FeSO_4$ 0.25%+ $ZnSO_4$ 0.5%, $FeSO_4$ 0.5%+ $ZnSO_4$ 0.25%, $FeSO_4$ 0.5%+ $ZnSO_4$ 0.5% and a control replicated three times to assess the effect of foliar application iron and zinc on flowering and yield characters of gladiolus. Results reveals that the spraying of $FeSO_4$ 0.5%+ $ZnSO_4$ 0.25% was proved most effective for early spike initiation (94.5 days), opening of first floret (102 days) and maximum duration of flowering (15.10days), Length of spike (103.4cm), Diameter of spike (1.53 cm), Number of florets/ spike (16.46), Number of corm/ plant (2.00), Number of corm/ha. (2.25 lakh) weight of corm/ plant (46.26g) However, vase life (13.90) was recorded maximum under $FeSO_4$ 0.25%+ $ZnSO_4$ 0.5%.

***Key Word* :** Gladiolus, Micro nutrients (Fe and Zn), foliar application, 3rd and 6th leaf stage

Introduction

Gladiolus (*Gladiolus grandiflorus* L.) is one of the most cultivated, economically important flowering plant world-wide and is among the elite cut flowers due to different shapes and prolonged vase life. Gladiolus, a member of family Iridaceae and sub-family Ixidaceae, originated from South Africa, is a prominent bulbous cut flower plant. The genus Gladiolus contains 180 species with more than 10,000 cultivars (Sinha and Roy, 2002). It is of great economic value as a cut flower and flower for decoration. It bears innumerable cultivars with assortment of attractive colors. Gladiolus is one of the most important bulbous flowering crops grown commercially for cut-flower trade in India. The suitable agro-climatic conditions of the country clearly indicate that a wide range of ornamental crops can be grown, which can improve the economic status of the growers. However, quality production is in dire need of standard agricultural practices, including nutrient management.

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Micronutrients play vital role in the growth and development of plants, due to their stimulatory and catalytic effects on metabolic processes and ultimately on flower yield (Lahijie, 2012) and quality (Khosa *et al.,* 2011). The growers lack in information on these elements and are not familiar with their prominent role in increasing yield and producing high quality cut flowers, causing soils deprived of micronutrients which in turn hamper plants to produce their optimum size of spike, corms and cormels for flower cultivation.

Zinc is an essential micronutrient necessary for sugar regulation and assorted enzymatic activity associated with plant growth. Zinc plays an important role in protein and starch syntheses, and therefore, a low zinc concentration induces accumulation of amino acids and reducing sugars in plant tissue. Zinc plays an important role in seed development and zinc-deficient plants show delayed maturity. Zinc is required for the synthesis of auxin IAA and for carbohydrate metabolism, protein synthesis, internode elongation for stem growth, pollen formation.

Zn^{2+} ions at low concentration (0.01 ppm) slightly enhance the activity of tryptophan synthesis leading to biosynthesis of auxin.

There are evidences that iron deficiency impairs many plant physiological processes because it is involved in chlorophyll and protein synthesis and in root tip meristem growth. Tagliavini & Rombola (2001) illustrated that iron deficiency (chlorosis) is a common disorder which affects plants. Grown on soils of high pHs. This may lead to serious yield and quality losses, demanding the implementation of suitable plant iron-deficiency correction strategies. Iron application through foliar spray is a common practice to cure iron-deficiency (Mortvedt, 1991).

Materials and Methods

The present investigation was carried out at the Main Experimental Station, Horticulture, N.D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) during the winter season of the year 2015-16. The experiment was laid out in Randomized Block Design (RBD) with nine treatments either alone or in combination of zinc and Iron replicated thrice to evaluate the effect on zinc and iron on flowering and yield of Gladiolus. The corms of Novalux variety was sown at 40 × 20 cm spacing in well prepared field in the month of October. The foliar application of micro nutrients *viz.* Zinc and Iron were applied at 3 leaf and 6 leaf stage. Nitrogen and phosphorus were applied in the form of urea and single superphosphate. Urea was applied in two split doses half amount as basal dose at the time of sowing of corms and half as top dressing 30 days after sowing, while phosphorus was used in single dose as basal does. Muriate of Potash (MOP) was applied as recommended dose at the time of final field preparation. Observations were recorded on at bud initiation stage and flowering attribute at different stage of plants. However the data had been statistically analyzed adopting procedure given by.

Results and Discussion

The minimum number of days required for spike initiation (94.50) and opening of first floret (102 days) were recorded with the spraying of $FeSO_4$ 0.5%+ $ZnSO_4$ 0.25%. This reduction in days to spike emergence might be due to Zn and Fe because these micronutrients are quite effective in reducing the juvenile period of plants and facilitates the storage of more carbohydrates through photosynthesis. Similar findings were also reported by Chattopadhayay *et al.* (2001), Jitendra *et al.* (2003) in carnation and Mir *et al.* (2007) in carnation. Maximum duration of flowering (15.10 days) was observed in with

Table 1: Effect of foliar feeding of zinc and iron on flowering and yield attributes of gladiolus (*gladiolus grandiflorus* L.) cv. Novalux.

Treatments	No. of days taken for spike initiation	No. of days taken for opening of first floret	Duration of flowering (days)	Length of spike (cm)	Diameter of spike (cm)	No. of spike per plant	Vase life (days)	No. of corm per plant	No. of corm per ha (lakh)	Average weight of corm per plant (g)	No. of cormels per plant
T_1 : Control	100.26	114.40	12.23	90.66	1.22	1.00	10.00	1.56	1.76	35.86	17.93
T_2 : $FeSO_4$ 0.25%	97.86	113.60	13.26	98.53	1.28	1.00	12.47	1.86	2.10	39.53	22.10
T_3 : $FeSO_4$ 0.5%	97.73	111.46	13.63	96.30	1.27	1.00	11.46	1.86	2.10	41.23	21.93
T_4 : $ZnSO_4$ 0.25%	97.80	108.63	14.10	100.06	1.36	1.00	11.13	2.00	1.98	34.86	19.43
T_5 : $ZnSO_4$ 0.5%	99.26	105.60	13.40	99.60	1.47	1.00	12.56	1.76	2.25	43.13	25.53
T_6 : $FeSO_4$ 0.25%+ $ZnSO_4$ 0.25%	95.83	109.80	15.00	98.56	1.24	1.00	13.63	2.00	2.25	42.53	20.56
T_7 : $FeSO_4$ 0.25%+ $ZnSO_4$ 0.5%	98.53	111.60	13.96	102.16	1.35	1.20	13.90	1.80	2.02	38.70	23.30
T_8 : $FeSO_4$ 0.5%+ $ZnSO_4$ 0.25%	94.50	102.00	15.10	103.40	1.30	1.20	12.00	2.00	2.25	46.26	28.80
T_9 : $FeSO_4$ 0.5%+ $ZnSO_4$ 0.5%	99.53	110.13	14.60	97.86	1.53	1.00	12.70	1.70	1.91	44.63	23.36
SEm±	**0.77**	**2.17**	**0.51**	**2.26**	**0.05**	**0.03**	**0.70**	**0.09**	**0.10**	**1.81**	**1.54**
CD at 5%	**2.31**	**6.52**	**1.53**	**6.78**	**0.16**	**0.10**	**2.09**	**0.27**	**0.31**	**5.42**	**4.61**

application of $FeSO_4$ 0.25% + $ZnSO_4$ 0.25% (**T_6**). This might be due to an early and enhanced growth by Zn and Fe and which also increased efficiency of physiological activities by Zn and Fe treated plants with respect to synthesis of metabolites reports made by Mir *et al.* (2007) in carnation. Highest spike length (103.40 cm) was recorded with the spraying of $FeSO_4$ 0.5%+ $ZnSO_4$ 0.25%. The differences in the response of micronutrients with respect to spike length might be due to the fact that these nutrients (Fe and Zn) activate several enzymes (catalase, peroxides, alcohol dehydrogenase, carbonic dehydrogenase, tryptophan synthetic, etc.) and involve them self in chlorophyll synthesis and various physiological activities by which plant growth and development are encouraged, Confirming the results of Kumar *et al.* (2004) in tuberose. The Maximum Diameter of spike (1.53cm) was recorded with the spraying of $FeSO_4$ 0.5%+ $ZnSO_4$ 0.5%. The greater thickness of spike was due to Fe and Zn because these micronutrients encourage the production of more food material which subsequently increased in the quality parameters, they also help in cell division and multiplication and enhance some physiological processes which are helpful to increase diameter of spike. Similar effects were also observed by Ahmad *et al.* (2010) in rose. The maximum number of florets per spike (16.46) was found with foliar application of $FeSO_4$ 0.5%+ $ZnSO_4$ 0.5% (**T_9**). The increase in number of florets per spike could be attributed to increase in photosynthesis with enhanced carbohydrate fixation in plants treated with micronutrient especially Zn. Similar findings are recorded by Chattopadhayay *et al.* (2001) in gladiolus and Munikrishanappa *et al.* (2002).

The Maximum vase life (13.9 days) was recorded with the spraying of $FeSO_4$ 0.25%+ $ZnSO_4$ 0.5% (**T_7**) The positive impact of micronutrients like zinc and iron might be due to the ability of these nutrients in activating several enzymes and its involvement in chlorophyll synthesis and various physiological activities ultimately increase the vase life. There result are in ciore conformity with the finding of Muthumanicham *et al.* (1999) in gerbera, Nagaraju *et al.* (2002) in gladious and Nagaraju *et al.* (2003) in rose.

The Maximum number of corm per plant (2.0) and corm per hectare (2.25 lakh) was recorded with the spraying of $FeSO_4$ 0.5%+ $ZnSO_4$ 0.25% (**T_8**). Increased the number of corms per plant/ hectare might be due to micronutrients like $ZnSO_4$ and $FeSO_4$. These micronutrients are the essential component of several dehydrogenase, proteinase, peptidase and promotes growth of hormones and closely associated with growth, all these factors contributed to cell multiplication, cell division and cell differentiation resulting in increased photosynthesis, translocation and storage of food material which enhanced the number of corms. Similar were findings also reported by Sharma *et al.* (2004) in gladiolus and Soni *et al*. (2015) in gerbera. The Maximum weight of corm per plant (46.26 g) was recorded with the spraying of $FeSO_4$ 0.5%+ $ZnSO_4$ 0.25% (**T_8**) The micronutrients (Fe and Zn) helps in nitrogen assimilation and synthesis of protein and also because of catalytic role in the activation of enzymes which promote cell division, multiplication and storage of food material. Similar results have been noted by Sharova *et al.* (1977) in gladiolus, Pratap *et al.* (2005) in gladiolus.

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