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Mini Review

Foliar application of micronutrients on gladiolus plants

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Growth, quality and yield of gladiolus plants are directly influenced by foliar application of micronutrients and play important role in changing vegetative and reproductive characters. Foliar application reduces the nutrient use efficiency and environmental pollution. During the development of bud stage, application of micronutrients combination performs better and a significant characteristic of nutrients improves the quality, shelf life of flowers and corm production. Keeping this in observation, micronutrients on the growth, quality and yield of gladiolus plant are study and reviewed in this paper.

Key words: *gladiolus, micronutrients, growth, quality, yield*

INTRODUCTION

Gladiolus (*Gladiolus grandiflorus* L.) is belonging to the family Iridaceae. Flower is called Queen of bulbous flowers, for its excellent aesthetic value, and display life. Importance of macronutrients, micronutrients also play important role in flower and corm yield and production. Micro nutrients apply as a foliar to absorb quickly by the plants. Most necessary and essential micronutrients, such as Zn, Fe, Mn, Cu and B having important role in the physiology of gladiolus plant and important part of catalytic enzymatic reaction. They are required in minute quantity but in important stages for plant actions such as respiration, meristamatic development, chlorophyll formation, photosynthesis, energy system, protein, oil synthesis, gossypol, tannin and phenolic compound development. All of the micronutrients may help to enhance uniform emergence, fast seedling growth and healthy plant stand. Some beneficial effects on corm yield and quality as reflected in possibility may be realized by applying these nutrients. Effects of foliar application of different micronutrients on gladiolus yield and flower quality have been extensively deliberate. Generally, the plant requires a variety of nutrients to improve the growth, quality and yield. Boron, Calcium and Magnesium are more efficient utilization for the performance of rapid cell division, enlargement, metabolism and postharvest life. In gladiolus plant, flowering is a continuous process of development. However, there are some flowers retained and remaining are highly affected due to nutritional stress. Hence need of proper management on time with proper micronutrients to produce more number of quality flowers and retain them on the plants to develop their post-harvest life for longer time, so that yield can be increased considerably. Physiological and biochemical process in the plant is directly affected by these micronutrients, which enables a rapid change in the physiology of plant within one season to attained desirable results. The essential mineral elements which are required in higher concentrations by the plant having sufficient need for reproduction of gladiolus often produces more vegetative growth, than needed for maximum corm production and yield especially when climatic condition favor for vegetative growth, these by directing the nutrients and photo assimilates towards vegetative growth relatively than reproductive growth.

Growth, Quality and Yield parameters of gladiolus as affected by foliar application of micronutrients

Chopde et al. (2015) noticed that, leaf area, plant height, yield in respect of spikes plant^{-1} and corms plant^{-1}, quality parameters *viz*. length of spike, rachis, florets spike^{-1}, diameter of spike and diameter of corm and the earliest 50 per cent flowering increased with the application of 0.4% zinc

and 0.4% iron, however, growth, quality, flowering and yield were found non-significant with the interaction between Zinc and Boron. Memon et al. (2013) reported that, application of $ZnSO_4$ and $FeSO_4$ applied @ 40 g $ZnSO_4$ + 20 g $FeSO_4$ respectively increased 14.44 leaves per plant, 115.70 cm leaves length, 22.88 per plant spike life, 14.55 florets spike^{-1}, 1.22 corms plant^{-1} and 17.33 corm lets plant^{-1} of gladiolus plant. Lahijie (2012) reported that, application of 1 % $FeSO_4$ produced earlier flowering than $ZnSO_4$, and also reduce emergence of spike (21.49 days) and opening of first floret (38.28). Similarly, 2% of both $FeSO_4$ and $ZnSO_4$ with combination in solution form decreased days to basal floret opening and florets number at a same time. Parameter including height (83.47 cm), spike length (66.03cm), number of leaves (9.52 plant^{-1}), floret number (11.55 spike^{-1}) and floret diameter (8.53cm) was significantly difference than other treatments when a equal mixed solution of 2% $FeSO_4$ and $ZnSO_4$ were applied. Reddy & Rao (2012) revealed that, 2% zinc increased plant height, leaf number, length, width and leaf area, more number of days (97.63) to first floret appearance and 50% flowering (103.32**),** first floret appearance and 50% flowering, number of spikes (1.33), spike length (112.19 cm), number of florets per spike and highest spike growth rate (0.68 cm/day), while in combination of 2% zinc and 6 weeks after planting the interaction effect recorded maximum spike length (118.36 cm) and number of florets (13.40), corm size (4.47 cm), corm weight (37.97 g), number of cormels (32.90) and cormel weight corm^{-1} (10.72 g). Similarly (Ahmad, et al., 2010) reported that, flower and corm yield, and quality effected significantly by essential micronutrients application. Eid et al. (2010) studied that, mixture of 3.0g Zinc/liter with 100 ppm BA, and 1.5g (Zn/liter) with 50 ppm BA, significantly affected the seedling growth of gladiolus. However, (Sing et al., 2010) stated that, Zinc x Iron and Zn x Copper with combination number of corm per plant, increase in cormels yield production per plant was efficiently influenced due to application of zinc (44.97) followed by spray of copper (43.18) and iron (42.11) of gladiolus significantly affected by the (Zn, Fe and Cu) interaction, whereas the number of corms plant^{-1} revealed by Zn (1.74), Fe (1.66) and Cu (1.68) as compare to control treatment. Kumar et al. (2009) in their study that $FeSO_4$.7H2O at 0.2% increased the number of flowers. Reddy & Chaturvedi (2009) found that, interactive effect of Boron and Zinc sulphate absolutely influenced days to flowering (66.13 days). Similarly, (Halder et al., 2007) observed that, flower parameters, such as weight and length of spike and rachis, weight and number of florets spike^{-1}, stick weights and size of the florets highly effected with the increase of B and Zn but increased in amount of B and Zn levels (B 2 and Zn 3 kg ha^{-1}) reduce the flower yield. Halder et al. (2007) studied that, Zn performs better in response to yield parameters of gladiolus but in combination they cannot perform obviously. Halder et al. (2007) stated that, Fe and Zn with combination of B concentration shows positive effect on gladiolus. Katiyar et al. (2005) reported that, vegetative growth, after seedling emergence and yield of gladiolus grown in partially sodic soil were significantly increased with application of Zinc. Paradhan et al. (2004) showed that, zinc application perform better on the following parameters such as leaf area, floret length and number of florets of gladiolus plant. Jitendra et al. (2003) observed that, macro and micronutrient is very important for plant growth and other characters of the plant. Roychowdhury & Sarkar (2000) found that, longevity of the spikes and hastened flower opening increased with treatment of $FeSO_4$ as compare to control in gladiolus. Prabhat & Arora (2000) studied that, flowers number and number of flowering stem of gladiolus plant were increased by micronutrients. Kumar & Arora (2000) found that, 0.2% FeSO4 alone and also in various combinations at three or six leaf stages on gladiolus induce flowering earlier. Kumar et al. (2000) reported that, flowering duration and Corm production per plant was extended along with 0.4% $FeSO_4$+0.2% $ZnSO_4$ in gladiolus. Chatturvedi et al. (1986) observed that, increase in corm size of gladiolus with foliar spray of Agromin (3000 ppm) and reported that nutrient present in Agromin might have increased the accumulation of nitrogen and proteins.

CONCLUSION

Conclusion made on the above review study, that micronutrients application as a foliar give quick response and leads to better results than direct soil application. Foliar application is frequently efficient when it is require in minute quantity and roots are unable to absorb sufficient amount from soil due to low soil temperature, high degree of fixation, losses from leaching, soil pH, lack of soil moisture, mobility of nutrients in soil and plants and hence foliar application of micronutrients in gladiolus can be considered as a beneficial practice for enhanced gladiolus growth, quality and yield.

AUTHOR CONTRIBUTION

Nadeem Khan collected the data from different research articles and reviewed. Asif Iqbal read the article and approved for publication.

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COMPETING INTERESTS

Not applicable.

ETHICS APPROVAL

Not applicable.

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