Influence of Boric acid and Iron Sulphate on vegetative, floral and bulbous growth of White Dutch Iris

Shahid Nadeem1*, Noor Alam Khan1, Hussain Shah2, Asma Hamid3, Muhammad Kashif Bakhtiar4

1Horticulture Research Institute, National Agricultural Research Centre, Islamabad, Pakistan
2Plants Sciences Division, Pakistan Agricultural Research Council, Islamabad, Pakistan
3Faculty of Food and Crop Science, Department of Horticulture Sciences, PMAS-Arid Agriculture, Rawalpindi, Pakistan
4Department of Agriculture, Abdul Wali Khan University Mardan, Pakistan

Key words: Dutch Iris, Boric acid, Iron sulfate, Geophytes, Growth.

http://dx.doi.org/10.12692/ijb/15.5.267-274 Article published on November 15, 2019

Abstract

Dutch Irises are popular bulbous plants which are used as cut flowers because of their attractive appearance and comparatively long-lasting vase life. Likewise, other bulbous plants they also need additional micronutrients to maintain their healthier life. However, this study aimed to investigate the effect of two micronutrients Boric Acid (H₃BO₃) and Iron Sulphate (FeSO₄) on morphological and bulbous growth of White Dutch Iris. The experiment was designed according to Randomized Complete Block Design (RCBD) with six treatments and three replications. The study had shown that foliar application of 1% H₃BO₃ along with 1% FeSO₄ had a significant impact on vegetative as well as floral growth in iris plants owing to maximum plant height (75.11±0.19cm), similarly the increment in leaf length (81.66±0.58cm), longest spike length (64.66±1.15cm) and rachis length (40.66±0.67cm) was observed. The number of leaves (9.66±0.33) and number of florets/spike (3.67±0.00) also enhanced but the number of days to bud color (157.45±0.69) and floret open (158.89±0.77) reduced expressively by the use of this combination, while the growth of controlled treatment showed poor results. Foliar spray of 2% H₃BO₃ was found highly effective to produce largest size of bulb (3.52±0.34cm) as well as maximum number of bulbs (6.60±0.20) while the weight of the bulb (31.66±0.42g) was found maximum. In conclusion, the impression of iron sulphate was positive as enhanced the floral growth and improves the bulbous characteristics while the combination of boric acid and Iron sulphate had positive affect on the overall growth of White Dutch Iris.

*Corresponding Author: Shahid Nadeem ☉ shahidnarc@gmail.com
Introduction
Geophytes have turned to be vital segments of floriculture because of their pleasant aromas, attractive floras and effortless care (Yazici et al., 2016). Furthest, they include tulip, irises, hyacinth, daffodil and day lilies. Irises stand an imperative position among all bulbous ornamental flowers cultivated in temperate regions and fits in Iridaceae family. Helvey (2009) reported that they were even recognized in antique Europe and introduced in gardens throughout the primitive eras. As indication derived their illustrations in art and several written books related to their use.

Royal Horticulture Society, revealed that bared-less irises have more economical value because of its perennial nature, bearing slender grass like leaves with erect stalk taking floras of 3 large scattering fall and 3 smaller erect petals. They stand favorite spring ornamental flowers for their attractive appearance as well as eco-friendly behavior in addition to improve the soil stability (Crișan et al., 2017) but the cultivation of iris is also depending on further factors such as temperature, light, water and agrochemicals similarly macro and micro nutrients. No doubt both have characters in the growth of bulbous flowering plants, regardless of macronutrients; micronutrients as well have a great impact on plant metabolic actions for healthier progress and their shortage cause decline in production as well as quality of flowers (Lahijie, 2012).

Iron takes part in respiration and struggles as O₂ carrier (Mamatha, 2007) while boron acts as stabilizer of cell wall pectin system (Dordas and Brown, 2005) and helps in firmness of cell wall construction with possible involvement in the integrity of the plasma membrane (Cara et al., 2002). Lilies respond with a great increment in plant height, leaf area, spike weight and chlorophyll content when treated with FeSO₄ (Singh et al., 2015), similar trends were also observed in gladiolus with foliar application of Zn (Sharma et al., 2013). A positive effect of zinc sulphate and iron sulphate on flower quality traits of tuberose was detected by (Patel et al., 2017) in term of length of flower spike, rachis length, number of florets per spike and also in-situ longevity of spike on the other hand application of boron along with NPKS is required to achieve higher yield of onion bulbs (Begum et al., 2015). Despite of having all these impressions, essentiality of micronutrients is still not recognized by several flower cultivators’ results in nutrient deficiency which badly changes the growth and production of flowers. Therefore, the study was performed to find out the response of different doses of boric acid and iron sulfate on vegetative, floral and bulbous growth in Bared-less/Dutch Irises.

Materials and methods
Experimental site and design
The present research study was conducted at field area of Horticulture Research Institute, National Agricultural Research Centre, and Islamabad, Pakistan during the year of 2018 to 2019. The experiment was replicated thrice according to Randomized Complete Block Design (RCBD) with six treatments. Each replication consisted of 10 plants.

Methodology
Dutch Iris (Iris × hollandica) cultivar Wedgewood was selected for field trials and sowed in the 4th week of October on ridges about 2.0-2.5 ft. row to row and 1.0 ft. plant to plant distance respectively. Foliar applications of Boric Acid (H₃BO₃) and Iron Sulphate (FeSO₄) were prepared with different concentrations. Six treatments were applied that is; T₃, control; T₁, 1% H₃BO₃; T₂, 2% H₃BO₃; T₃, 1% FeSO₄; T₄, 2% FeSO₄; T₅, 1% H₃BO₃ + 1% FeSO₄. All standard agricultural cultural practices like irrigation, weeding, hoeing, plant protection measures required for iris production were carried out in all the treatments. Data regarding different parameters of plant such as plant height, length of spike, length of rachis, length of leaf, total weight of bulbs/plant, largest weight of bulb, smallest weight of bulb, largest size of bulb, smallest size of bulb was measured by using measuring tape, electric weighing balance and Vernier scale while other characteristics alike number of leaves, days to spike emergence, days to bud color, days to floret open, total number of bulb
/plant, number of florets /plant was recorded respectively by visual observations.

Statistical analysis
The data collected on different parameter was statistically analyzed by using software statistics 8.1. Analysis of variance and the means were compared at 5% level of significance (Steel et al. 1997).

Results and discussion
Effect of Boric acid and Iron sulfate on vegetative growth of White Dutch Iris
Foliar spray of micronutrients on Dutch irises considerably affected all the parameters of vegetative characteristics. The outcomes of the present study suggest that the combination of 1% of H$_3$BO$_3$ with 1% FeSO$_4$ produced maximum plant height (75.11±0.19 cm) tracked by 1% FeSO$_4$(70.44±1.02 cm) and (66.44±0.51cm) plant height was detected by mean of 1% H$_3$BO$_3$. There have been numerous studies in the literature reporting that foliar application is more advantageous than soil application for plants which are incapable to transfer nutrients from the soil because of several physical or chemical properties of the soil (Singh et al., 2015). However, the correlation between 2% H$_3$BO$_3$ and 2% FeSO$_4$ is interesting because the results on plant heights were statically a little differed (66.22±1.07) and (63.82±0.83cm) respectively.

Table 1. Effect of Boric acid and Iron sulfate on vegetative growth of White Dutch Iris.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant height (cm)</th>
<th>No of leaves</th>
<th>Spike emergence days</th>
<th>Leaf length (cm)</th>
<th>Spike length (cm)</th>
<th>Rachis length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T$_0$</td>
<td>58.11±0.51</td>
<td>6.77±0.51</td>
<td>161.78±1.54</td>
<td>65.0±0.88</td>
<td>49.67±1.73</td>
<td>30.22±1.17</td>
</tr>
<tr>
<td>T$_1$</td>
<td>66.44±0.51</td>
<td>7.55±0.51</td>
<td>158.55±0.69</td>
<td>71.33±1.88</td>
<td>55.44±1.35</td>
<td>38.33±0.58</td>
</tr>
<tr>
<td>T$_2$</td>
<td>66.22±1.07</td>
<td>8.22±0.51</td>
<td>158.11±0.19</td>
<td>74.22±1.35</td>
<td>57.55±0.88</td>
<td>35.11±0.19</td>
</tr>
<tr>
<td>T$_3$</td>
<td>70.44±1.02</td>
<td>9.22±0.38</td>
<td>156.22±0.38</td>
<td>73.33±2.03</td>
<td>61.11±1.92</td>
<td>39.11±1.07</td>
</tr>
<tr>
<td>T$_4$</td>
<td>63.82±0.83</td>
<td>8.44±1.09</td>
<td>156.56±0.19</td>
<td>73.78±0.84</td>
<td>58.88±0.51</td>
<td>34.22±0.38</td>
</tr>
<tr>
<td>T$_5$</td>
<td>75.11±0.51</td>
<td>9.66±0.33</td>
<td>154.11±0.38</td>
<td>81.66±0.58</td>
<td>64.66±1.15</td>
<td>40.66±0.67</td>
</tr>
</tbody>
</table>

The results observed in treatment (T$_0$) were not at par compared to all the other treatments as gave plant height (58.11±0.51cm). Similar results were found by (Hussain and Ahmad, 2018) when the bulbous plants were treated with foliar application of micronutrients and plant’s progress was desirable and healthier in relation to plant height.

The present findings also support (Sharma et al., 2013) study which concluded that the height of gladiolus’s plant improved through foliar application of Zn, B and Ca (79.55cm, 79.39cm and 78.75cm, respectively) but collaboration outcomes stayed noteworthy between B×Ca, Zn×B and Ca×Zn (79.16cm, 80.34 and 79.22cm, respectively) and the supreme tallness of plant (79.55cm) was achieved by the application of zinc. The research study showed that H$_3$BO$_3$ along with FeSO$_4$ yields well qualitative and quantitative effects on plant height as compared to the other treatments (Table1). Estimation of means concerning with number and length of leaves/Plant revealed that foliar spray of 1% H$_3$BO$_3$ along with 1% FeSO$_4$ also performed well in this character with (9.66±0.33) leaves number and(81.66±0.58 cm) leave length in comparison with average number (9.22±0.38) and length (73.33±2.0cm) of leaves nourished with 1% FeSO$_4$. The more surprising correlation is with the foliar application of 2% FeSO$_4$ and 2% H$_3$BO$_3$ with (8.44±0.19 and 8.22±0.51) numbers of leaves plant$^{-1}$ and (73.78±0.84cm and 74.22±1.35 cm) length of leaves correspondingly.

It was found that 1% H$_3$BO$_3$ gave the satisfactory number of leaves (7.55±0.51) with shorter length (71.33±0.88cm). Our findings revealed that controlled section expressed lowest number and length of leaves (6.77±0.51 and 65.0±0.88cm respectively).
These findings are consistent with findings of past studies by (Khalifa et al., 2011) which explained that foliar application of H₃BO₃ (0, 5, 10 or 20 ppm) unaided or in several mixtures are pragmatic to increase the number of leaves per plant in Iris. Furthermore, Hussain and Ahmad (2018) disclosed the increment in the number and length of leaves of gladiolus plant by 0.2% FeSO₄. Previous research has shown that ZnSO₄ at 0.2% also had noticeable flashes on size of elongated leaf with extreme width verified to be 3.63 cm which stood statistically at par with ZnSO₄ 0.4% treatment but substantial to further treatments (Singh et al., 2012). Lahijie (2012) published a paper in which he described that foliar application of FeSO₄ and ZnSO₄ (0.5 or 1%) alone or in blending and at 2- and 6-leaf stages, meaningfully improved number of leaves per plants in gladiolus. Based on the results plants in T₅ (combination of 1% FeSO₄ and 1% H₃BO₃) took minimum number of days (154.11±0.38) for spike influx/emergence in contrast with 2% FeSO₄ (156.56±0.19) days. The calculation in this work proposed that 1% FeSO₄ had a little variance in spike emergence days (156.22±0.38) when equated to the further treatments alike 1% H₃BO₃ and 2% H₃BO₃ with (158.55±0.69) days and (158.11±0.19) days respectively, which were found to be expressively parallel to one another as publicized in Table 1. The maximum number of days for spike appearance were calculated in controlled plants (161.78±1.54) as compared to all other treatments but the deduction stays at diverse side with findings of previous research by (Patel et al., 2017) in tuberose plants, the days to spike emergence was prior in control (T₅) plants as compared to the plants sprayed by FeSO₄ and H₃BO₃.

The fallouts of the arithmetical imitation indicate that the maximum length of spike (64.66±1.15cm) was pragmatic through 1% FeSO₄ +1% H₃BO₃. The application of 1% FeSO₄ also provided supplementary length of spike (61.11±1.92cm) while plants sprayed by 2% FeSO₄ and 2% H₃BO₃ exhibited significantly similar length (58.88±0.51cm and 57.55±0.88cm). In table 1 there is a clear trend of decreasing in length of spike (55.44±1.35cm), although minimum (49.67±1.73cm) length of spikes per plant was experimented in treatment T₅ (control). Consistent with findings by (Patel et al., 2017) as found that when the combination of FeSO₄ 1.5 % + 0.1 % Ca + ZnSO₄ 0.5 % + 0.1 % CaCO₃ were applied to tuberose plant that lead to maximum length of flower spike (144.53 cm), rachis length (43.3 cm). Assessment of different concentration of micronutrients exposed that the maximum length of rachis (40.66±0.67cm) obtained by the combination of 1% FeSO₄ and 1% H₃BO₃ tracked via 1% FeSO₄ (39.11±1.07cm) and 1% H₃BO₃ (38.33±0.58cm) separately. This study also indicates that 2% H₂BO₃ and 2% FeSO₄ presented comparable results with (35.11±0.99 and 34.22±0.38) rachis length, respectively. It has been observed that control plants produced minimum length of rachis (30.22±1.17cm) exploration verdicts by (Chopde et al., 2015). Also points the treatment of plants with 0.4% Fe and 0.4% Zn resulted in maximum length of rachis.

**Effect of Boric acid and Iron sulfate on floral growth of White Dutch Iris**

Days to bud color were noted from the period of planting to development of floral buds on the plants. The findings regarding with number of days to bud color showed that the plants treated with 1% FeSO₄ +

---

**Table 2. Effect of Boric acid and Iron sulphate on floral growth of White Dutch Iris.**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Days to bud color</th>
<th>No of floret/spike</th>
<th>Days to floret open</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₃</td>
<td>164.33±1.54</td>
<td>2.67±0.00</td>
<td>165.67±1.53</td>
</tr>
<tr>
<td>T₁</td>
<td>160.56±0.51</td>
<td>3.11±0.19</td>
<td>162.00±0.33</td>
</tr>
<tr>
<td>T₂</td>
<td>161.22±0.19</td>
<td>3.33±0.00</td>
<td>162.56±0.19</td>
</tr>
<tr>
<td>T₃</td>
<td>158.89±0.96</td>
<td>3.33±0.00</td>
<td>160.22±0.69</td>
</tr>
<tr>
<td>T₄</td>
<td>160.33±0.00</td>
<td>3.33±0.00</td>
<td>161.78±0.19</td>
</tr>
<tr>
<td>T₅</td>
<td>157.45±0.69</td>
<td>3.67±0.00</td>
<td>158.89±0.77</td>
</tr>
</tbody>
</table>
1% H$_2$BO$_3$ acquired least number of days (157.45±0.69) for bud color and 1% FeSO$_4$ attained (158.89±0.96) days with a little variance. Table 2 demonstrates that spraying plants with 2% H$_2$BO$_3$ took (161.22±0.19) days for bud color appearance while treated with 1% H$_2$BO$_3$ and 2% FeSO$_4$ (160.56±0.51 and 160.33±0.00) days respectively, which were analyzed dramatically equal to one another. The finding provides evidence that the extreme sum of days from spike appearance to bud color were deliberated in T$_3$. From these data we can see that the minimum number of days (161.78±0.19) was recorded with the blending spray of H$_2$BO$_3$ and FeSO$_4$. Ahmad et al. (2010) tested during their study on micronutrients in 2010 that plants nourished by Boron only or with mixture of other nutrients acquired early flowering when they are linked/compared to unnourished plants. The results are consistent with conclusions of past studies by (Chopde et al., 2015) which were studied the impression of iron concerning with appearance of blossoming time in gladiolus. On the other hand, Comparable outcomes were also presented by (Balakrishnan et al., 2007) in African marigold by 0.5% FeSO$_4$.

**Table 3. Effect of Boric acid and Iron sulphate on bulbous growth of White Dutch Iris.**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>No of bulbs / plant</th>
<th>Total weight of bulbs/plant (g)</th>
<th>Largest bulb weight (g)</th>
<th>Smallest bulb size (cm)</th>
<th>Largest bulb size (cm)</th>
<th>Smallest bulb size (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T$_0$</td>
<td>4.73±0.12</td>
<td>50.60±0.20</td>
<td>23.53±0.21</td>
<td>2.18±0.20</td>
<td>2.58±0.34</td>
<td>1.40±0.10</td>
</tr>
<tr>
<td>T$_1$</td>
<td>5.08±0.25</td>
<td>57.40±0.53</td>
<td>26.70±0.26</td>
<td>3.27±0.76</td>
<td>2.97±0.07</td>
<td>1.51±0.11</td>
</tr>
<tr>
<td>T$_2$</td>
<td>6.60±0.20</td>
<td>69.20±0.40</td>
<td>31.66±0.42</td>
<td>2.76±0.38</td>
<td>3.52±0.34</td>
<td>1.40±0.16</td>
</tr>
<tr>
<td>T$_3$</td>
<td>5.70±0.10</td>
<td>65.13±0.42</td>
<td>26.6±0.42</td>
<td>3.66±0.61</td>
<td>2.95±0.06</td>
<td>1.59±0.14</td>
</tr>
<tr>
<td>T$_4$</td>
<td>5.23±0.15</td>
<td>61.26±0.58</td>
<td>26.33±0.20</td>
<td>3.33±0.23</td>
<td>2.65±0.25</td>
<td>1.66±0.12</td>
</tr>
<tr>
<td>T$_5$</td>
<td>6.20±0.20</td>
<td>68.23±0.25</td>
<td>29.56±0.21</td>
<td>3.26±0.12</td>
<td>2.99±0.01</td>
<td>1.8±0.06</td>
</tr>
</tbody>
</table>

One of the most important present deliberations in this research is the number of days to opening of florets recorded from the time of planting to the day of floret open. Results highlights that each treatment presented diverse reply towards the number of days to floret open. Our finding discovered that T$_0$ (control) grabbed maximum number of days (165.67±1.53) trailed by T$_2$ (2% H$_2$BO$_3$) and T$_1$ (1% H$_2$BO$_3$) which were seized (162.56±0.19) and (162.00±0.33) days. Among the credible elucidations for these findings is that when FeSO$_4$ is applied 2% it affected as opened the florets in (161.78±0.19) days although FeSO$_4$ is applied 1% took (160.22±0.69) days. From this data we can see that the minimum number of days (158.89±0.77) was recorded with the blending spray of H$_2$BO$_3$ and FeSO$_4$. Ahmad et al. (2010) tested during their study on micronutrients in 2010 that plants nourished by Boron only or with mixture of other nutrients acquired early flowering when they are linked/compared to unnourished plants. The results are consistent with conclusions of past studies by (Chopde et al., 2015) which were studied the impression of iron concerning with appearance of blossoming time in gladiolus. On the other hand, Comparable outcomes were also presented by (Balakrishnan et al., 2007) in African marigold by 0.5% FeSO$_4$.

**Effect of Boric acid and Iron sulfate on bulbous growth of White Dutch Iris**

It appears from the aforementioned investigations that most attention has been paid to know the importance of these micro-essential nutrients to improve the health of a plant. The results of our research indicated that the largest number of bulbs (6.60±0.20) produced from the plants which were treated with 2% H$_2$BO$_3$. The results also show that combination of FeSO$_4$ and H$_2$BO$_3$ ranked second
position with (6.20±0.20) bulbs per plant. The association among 1% FeSO₄, 2% FeSO₄ and 1% H₃BO₃ is stimulating for the reason that they had a little difference in production of bulblets/plants (5.70±0.10, 5.23±0.15, 5.08±0.25) respectively. The current discoveries also suggest that the least number of bulbs (4.73±0.12) were estimated in T₃ (control). Manna and Maity (2016) provided in-depth analysis of the same work on bulbous growth of onion. The result is in the lines of earlier literature (Hussain and Ahmad, 2018) that found the number of corms formed/plant speckled as of 1.0 to 1.2; hence neither a solo foliar application of micronutrients nor in mixture have any effect on corm figure/plant. This work presents that a dose of 2% H₃BO₃ performed well as compared to all other treatments because of holding the heavier weight (69.20±0.40g) of bulbs per plant but when we applied H₃BO₃ with 1% FeSO₄ produced (68.23±0.25g) weight of bulbs. Indicate that 1% FeSO₄ tempted (65.13±0.42g) bulbs total weight. It was found that 2% FeSO₄ had a weight of bulbs (61.26±0.58g) and 1% H₃BO₃ was (57.40±0.53g). The lowest weight of bulbs (50.60±0.20g) was recorded in controlled plant. (Manna, 2013) found that boron triggered substantial development in bulb diameter, individual bulb weight, marketable and total yield, which is in good agreement with the results of the present study. Neck thickness (1.39 cm) and bulb weight (57.1 g) were formed by 0.5% boron application imperative to thorough going marketable (25. 9t h-1) and total yield (30.7t h-1) of onion. Furthermore, analogous consequences were attained by (Manna and Maity, 2016).

The results showed that foremost bulb weight was obtained (31.66±0.42) by 2% H₃BO₃ and (29.56±0.21) by the collaboration of 1% H₃BO₃ and 1% FeSO₄. It was also noted that the other three treatments alike 1% H₃BO₃, 2% FeSO₄ and 1% FeSO₄ carried the weight of bulb of (26.70±0.26g, 26.33±0.20 and 26.6±0.42g) respectively. The lowermost weight of bulb (23.53±0.21g) signified in controlled plants. Hussain and Ahmad (2018) presented a comprehensive view for corm weight designated substantial variances between treatments. The corms of gladiolus added maximum weight under mutual application of micronutrients significantly higher than the corm weight formed in further treatments. Similar consequences also settled the findings of (Ahmed et al., 2002; Halder et al., 2007) who observed foliar application of different micronutrients increased corn weight in gladiolus. The evidence from this study suggests that the smallest weight of bulb per plant was observed in T₃ (1% FeSO₄) ranked the first position with weight of (3.66±0.61g). The present work also displayed that all further treatments T₄ (2% FeSO₄), T₅ (1% H₃BO₃) and T₆ (1% FeSO₄+1% H₃BO₃) with weight of (3.33h±0.23g, 3.27h±0.76g and 3.26h±0.12g) correspondingly. The finding highlighted that T₂ (2% H₃BO₃) produced (2.76h±0.38g) and the minimum weight (2.18h±0.20g) was detected in T₃ (control). (Singh et al., 2012) stated that foliar application of Zn (0.50%) improved weight of corms in gladiolus. Treatment of either ZnSO₄ (0, 0.15, 0.30 or 0.45%) or H₂BO₃ (0, 5, 10 or 20 ppm) either single or in various blends as foliar spray also significantly increased both fresh and dry weight of bulbs in Iris (Khalifa et al., 2011). Table 2 directs that the largest bulb size was depicted as (3.52±0.34) by the application of H₂BO₃ @ 2% and (2.99±0.01) by the combination of H₂BO₃ and FeSO₄ @ 1%. The discussion of the results transmits with the nourishing of plants by 1% H₂BO₃, 1% FeSO₄ and 2% FeSO₄ carried size of bulb of (2.97±0.07, 2.95±0.06 and 2.65±0.25) respectively. It was stated that in controlled plants, the shortest size of bulb was (2.58±0.34) among all the treatments as represented in Table.3. In instant, several fascinating grades signifying the potential of micronutrients have been reported, but most of the revisions in the open literature did not instantaneously observe the impact of the amalgamation that formed expressively largest size bulblets of tuberose was that of 150 mg·L⁻¹ N united with 0.5% iron sulfate and 0.05% citric acid (Eidyan et al., 2014). The mean comparison of treatments regarding the smallest size of bulb per plant described the dominance of 1% H₂BO₃+1% FeSO₄ (1.80±0.06) over all other treatments. Our findings exposed that T₄ (2% FeSO₄) formed
(1.66\text{ab} \pm 0.12) size of iris bulb while T\textsubscript{3} (1% FeSO\textsubscript{4}) grew (1.59\text{abc} \pm 0.14). Table 3 depicted the overcomes of 1% H\textsubscript{3}BO\textsubscript{3} as (1.51\text{bc} \pm 0.11) and the shortest size of bulb were produced with foliar application of 2% H\textsubscript{3}BO\textsubscript{3} and controlled treatment (1.40\text{c} \pm 0.10) with relatively no difference. Research finding by (Chopde et al., 2015) also leads towards impression of gladiolus bulb size by micronutrients especially FeSO\textsubscript{4}.

**Conclusion**

The results presented here facilitate the improvements in growth parameters of iris plant. However, from findings of the present study, it can be concluded that the foliar application of micronutrients boric acid and iron sulphate at the time of planting and later on, had a positive effect on the vegetative and floral growth of the plant and also influenced greatly on bulbous characteristics. Although, the plants grown in control zone remain unaffected and showed no variation regarding all parameters excluding the bulb size and weight.

**References**


https://doi.org/10.1016/S0981-9428(02)01447-X

http://plantarchives.org/PDF%202015%20-%2015%20417%20419%20(2853).pdf

https://journals.usamvcluj.ro/index.php/promediu/article/view/12894

https://link.springer.com/article/10.1007/s11104-004-0309-1

http://dx.doi.org/10.1007/s13580-014-0061-2


Hussain S, Ahmad M. 2018. The Effect of Micronutrients (B, Zn and Fe) Foliar Application on the Growth, Flowering and Corm Production of Gladiolus (Gladiolus grandiflorus L.) in Calcareous Soils. http://hdl.handle.net/123456789/4095


