EFFECT OF IRON SULFATE AND BORIC ACID ON BULB/BULBLETS PRODUCTION OF DUTCH IRIS

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ABSTRACT

Nutrients availability plays a crucial role in overall growth and development of plants, specifically influencing the production of bulbs and bulblets in bulbous flowering plants. Here, in this experiment we analyze the performance of bulbs and bulblets production for Dutch Iris under application of Iron Sulfate and Boric Acid. Trials were conducted at the field of Directorate of Floriculture, Horticulture Research Institute (HRI) in National Agriculture Research Center Islamabad (NARC). The experiment was laid out according to Randomized Complete Block Design (RCB) with six treatments and four replications. Treatments includes **T1 (**Control), **T2** (1% Boric Acid), **T3(**2% Boric Acid), T4(1% Iron), T5 (2% Iron sulfate) and T6 (1% Boric Acid + 1%Iron Sulfate). Each treatment replicated four times during the experiment. The variety "White Dutch Iris" was used during the experimental trials. Bulbs for variety "Dutch Iris" of optimum weight (25-30 gm) were harvested on ridges respectively. The bulbs were dried under the shade condition, afterward the bulbs were washed for sterilization in fungicide solution (redomel gold and elite for 20 mints) and subsequently data was collected on for size and diameter of each bulb and bulblets. The results depicted that $FeSO_4$ and H_3BO_3 solutions had significantly affected various parameters during the study. From these results it was also noted that balance amount of Boric Acid (H_3BO_3) and Iron Sulfate ($FeSO_4$) has good effect on Bulbs. Maximum number of bulb (4.2) was recorded in treatment T_6 (1%Boric Acid+1% Iron Sulfate) while minimum (3.46) number of bulbs was recorded in treatment T_1 (Control). Moreover, the maximum number of bulbs per plant (6.06) was recorded in treatment T_4 (1% Iron Sulfate) while minimum number of bulbs per plant (5.2) was recorded in treatment T_2 (1% Boric Acid). The outcome of our study demonstrated that the greater number of bulbs (6.60a±0.20) formed from the plants which were treated with 2 percent H_3BO_3. The amount of bulblets of the Dutch iris plants was extensively superior T_2 (1 percent H_3BO_3) at solution. The relationship among 1 percent $FeSO_4$+2 percent $FeSO_4$ and 1 percent H_3BO_3 is inspiring for the explanation that they had a minute dissimilarity in making of bulblets/plants (5.70c±0.10, 5.23d±0.15, 5.08d±0.25) in that order. While determining the weight of largest bulbs maximum bulb

weight(28.6gm) was observed in treatment T_2 (1% Boric Acid) with foliar application of 1 percent Boric Acid. Furthermore, the mean values significantly affected bulb weight with different levels of Boric Acid and Iron Sulfate. It was concluded from the above results discussed that Iron Sulfate($FeSO_4$) and Boric Acid (H_3BO_3) have significant effect on the Bulbs of Dutch Iris.

INTRODUCTION

Iris (*Iris hollandica*) is a significant cut flower of Iridaceae family. Among the fall bulbs, the Dutch Iris has the value like a ruler because of its ideal three enormous petals and ostentatious blossoms. Iris has been utilized in nurseries and parks as fancy plant since antiquated events because of its excellent and multi shaded blossoms (Bukhari RAS, 2005). In excess of 300 types of iris have been dispersed certainly in the Northern Hemisphere (De LK, Bhattacharjee SK., 2003)

Iris × *hollandica* usually identified as the Dutch iris, is a crossover variety, created from those species, which is originated in Spain, North Africa and Portugal. Iris × hollandica has a bulb of about 10 centimeters (3.9 in) and can reach a height of about 60 centimeters (24 in). This iris has restricted straight green leaves and tolerates largish blue to yellow to white blossoms, and they don't have any aroma.

Geophytes have turned to be vital segments of floriculture because of their pleasant aromas, attractive floras and effortless care (Yazisi, 2016). Further, 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. Halvey,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,2015 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 (Loana 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 also have a great impact on plant metabolic actions for healthier progress and their shortage cause decline in production as well as excellency of flowers (Lehijie,2012). Iron takes part in respiration and struggles as O2 carrier (Mamtha,2007) while boron acts as stabilizer of cell wall pectic system (Dordas & 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 $FeSO_4$ (Singh et al,2015), similar trends were observed in gladiolus with foliar application of Zn (Sharma et al, 2013). A great impact of iron sulphate and zinc sulphate on flower quality parameters 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 (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 and floral growth in bared-less irises.

Boric acid is a white powder or uncolored gem that is a feeble corrosive of boron. It was recently utilized as a disinfectant and is currently more regularly utilized as a bug spray (insecticide) and in various assembling measures.

Ornamental plants are viewed as one of the auspicious produces in Egypt. Iris plant is a significant and famous cut bloom grown in every place around the globe. Iris blossoms tolerate a financial and tasteful incentive for its magnificence and tastefulness. The long bloom spikes are great as cut blossom for ornamentation when orchestrated in containers. Iris blossoms are one fundamental exportable bloom and the overseas business sectors request Egyptian blossoms with high caliber and must match the global standers of exportable blossom. However, the fundamental issue the ranchers are faceting legal utilization of synthetic manures, the prerequisite of manures like different crops has crucial part in development, nature of blossoms, bulbs and bulblets creation, particularly when filled in recovered soil. In this fear,Mahgoub et al. (2006) referenced that further additions in nitrogen level 35gK/m2+40g/m2 N recorded the most noteworthy estimations of spike length, number of blossoms/spikes of iris and plant height. Paradhan et al. (2004) additionally found that on gladiolus, consolidated use of K at 30g/m2 and N at 40/m2 recorded the most noteworthy estimations of plant, spike length, leaf area, number of blossoms/spikes. Micronutrients had incredibly influenced on plant development and improvement, for example, zinc and boron supplements. The fundamental capacity of boron identified with cell wall quality and advancement, sugar transport, cell division, RNA digestion, hormones improvement, Indole acidic corrosive (IAA) digestion, breath, and as a feature of the cell membranes (Marchner 1995). In gladiolus plant, Halder et al. (2007) found that utilization of boron at 2.5Kg/ha-1 could be appropriate for more yield and blossom quality. Zinc assumes a fundamental part in plant physiology where it initiates some of enzymes and identified with digestion of carbohydrates, auxins, RNA and ribosome capacities. The gainful impact of zinc on a few ornamental plants were contemplated, Farahat et al (2007) on Cupressus sempervirens L., Halder et al. (2007) on gladiolus, Razin et al. (1992) on thyme. In an answer culture study (Grahn et al. 1987) revealed that boron poisonousness was more cuts off and showed up first in zinc inadequate in grain plants contrasted and those provided with satisfactory Zn, as announced by Singh et al. (1990), on wheat, Zn insufficiency may improve B ingestion and transport so much that B may potentially aggregate to poisonous levels in plant tops. Accordingly, the ongoing examination intends to consider the impact of zinc and boron application just as their mixes on development, bloom attributes, synthetic constituents, mineral supplement substance and blossoms basic oil substance of iris plant.

II RESEARCH METHODOLOGY

Work Plan and Methodology:

The experiment was directed at Floriculture research programme, HRI, National Agriculture Research Center Islamabad (NARC), started from July 3, 2019. The experiment was laid out according to RCB design with six treatments and four replications. The variety "White Dutch Iris" was used during the experimental trials. The Dutch Iris bulbs of optimum weight (25-30 gm) were harvested on ridge respectively. The bulb dried under the shade. The bulbs were washed for sterilization in fungicide solution (redomel gold and elite for 20 mints). The next day data was collected on size of each bulb and bulblets with the help of Vernier caliper. After that we measure the weight of every largest bulb and smallest bulblets with the help of top load weighing scale. The data was tabulated and analyzed using statistics 8.01. Significant and non-significant figures were ascertained for results band discussion.

III MATERIALS:

- Digital weighing balance,
- Vernier caliper,
- Calculator,

Treatments: 6

- **T1 =** Control,
- **T2**= 1% Boric Acid,
- **T3**= 2% Boric Acid,
- **T4**= 1% Iron sulfate,
- **T5**= 2% Iron sulfate,
- **T6**= 1% Boric Acid + 1%Iron Sulfate,

IV RESULTS AND DISCUSSION

NUMBER OF BULBS PER BULBLETS:

Number of bulbs/bulblets always play very important role. Data concerning boric acid and Iron Sulfate was collected as the treatment were already applied in the field experiment applying treatment with different concentrations. Statistical analysis of the data was carried out using statistics 8.01 and the results are given in Table (4.1) with the perusal of given treatments. Results of Iron Sulfate with different concentrations have showed non-significant result. The maximum number of bulbs per plant (6.06) was recorded in treatment T_4while minimum number of bulbs per plant (5.2) was recorded in treatment $T_{2.}$ The outcome of our study demonstrated that the greater number of bulbs (6.60a±0.20) formed from the plants which were treated with 2 percent H_3BO_3. The fallout also illustrates that mixture of $FeSO_4$ and H_3BO_3 ranked second position with (6.20b±0.20) bulbs per plant. The association among 1 percent $FeSO_4$, 2 percent $FeSO_4$ and 1 percent H_3BO_3 is inspiring for the basis that they had a slight distinction in development of bulblets/plants (5.70c±0.10, 5.23d±0.15, 5.08d±0.25) correspondingly. The present discovery also proposes that the smallest number of bulbs (4.73e±0.12) were noted in T_o (control) (Nadeem *et al.*, 2020).

Table 4.1: Analysis of variance for the effect of Iron Sulfate and Boric Acid on NOB/bulblets

Source	DF	SS	MS	F	P
Replication	23.95111	1.97556			
Treatment	51.59111	0.31822	0.82	0.5634NS	
Error	10	3.88889	0.38889		
Total	179.43111				

**=Highly Significant (P<0.01); *=Significant (P<0.05); NS=Non-Significant

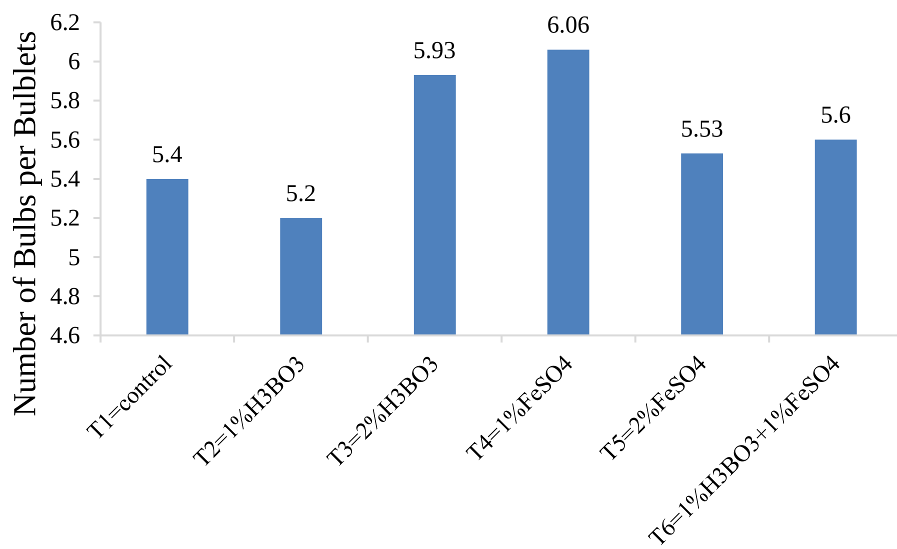

Figure 1. Effect of Iron Sulfate and Boric Acid on number of bulbs/bulbletsNUMBER OF BULBS:

The data was statistically analyzed using statistics 8.01 software for each bulb and ANOVA was applied to find out the differences among the treatments. The effect of Iron Sulfate and Boric Acid on bulb of Dutch Iris plant is shown in Table 4.2and as the results obtained from the foliar application boric acid was found non-significant. Maximum number of bulb (4.2) was recorded in treatment T_6while minimum (3.46) number of bulbs was recorded in treatment T_1. The figure of bulbs of the Dutch iris per plants was considerably higher inT_6 at 1 percent $FeSO_4$+1 percent H_3BO_3 solution. Manna and Maity (2016) provide in-depth investigation of the similar work on bulbous enlargement of onion. The consequence is in the ranks of previous text. (Hussain and Ahmad, 2018) establish the quantity of corms formed/plant freckled as of 1.0 to 1.2, therefore, neither a singly foliar appliance of micronutrients nor in combination have any impact on corm figure/plant.

Table 4.2: Analysis of variance for the effect of Iron Sulfate and Boric Acid on NOB.

Source	DF	SS	MS	F	P
Replication	2	4.60444	2.30222		
Treatment	5	1.29778	0.25956	0.85	0.5443NS
Error	10	3.04889	0.30489		
Total	17	8.95111			

**=Highly Significant (P<0.01); *=Significant (P<0.05); NS=Non-Significant

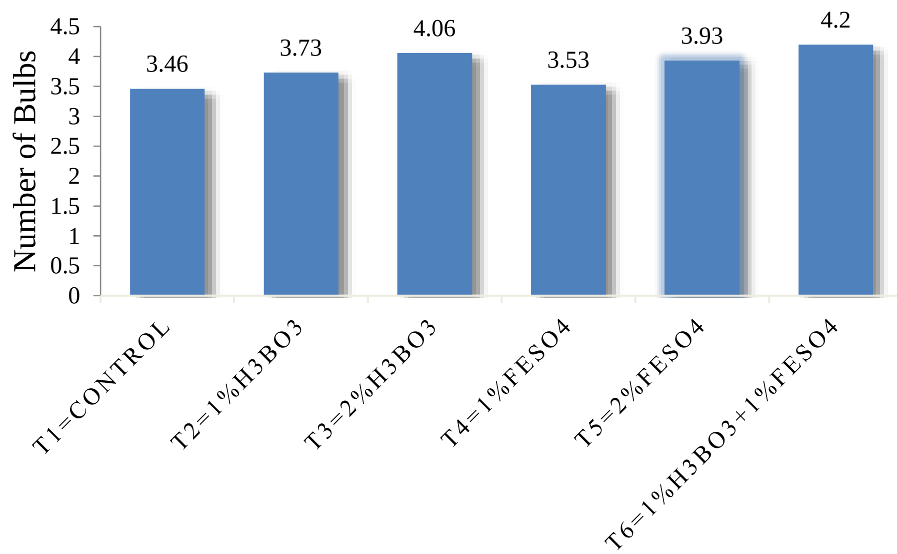

Figure 2. Effect of Iron Sulfate and Boric Acid on number of bulbs

NUMBER OF BULBLETS-01:

The data collected from the treatment of Boric Acid and Iron sulfate showed non-significant difference while determining the number of bulblets. The data was statistically analyzed for each bulblets produced by Dutch Iris planted ANOVA applied was to find out he effect of different concentrations of Iron Sulfate and Boric Acid. Maximum number of bulb (2.4cm) was recorded in treatment T_2while minimum (1.66cm) number of bulbs was recorded in treatment T_5. The amount of bulblets of the Dutch iris plants was extensively superior T_2 1 percent H_3BO_3 at solution. The relationship among 1 percent $FeSO_4$, 2 percent $FeSO_4$ and 1 percent H_3BO_3 is inspiring for the explanation that they had a minute dissimilarity in making of bulblets/plants (5.70c±0.10, 5.23d±0.15, 5.08d±0.25) in that order. It shows from the afore reference study that the majority of concentration has been rewarded to recognize the significance of these micro-essential nutrients to recover the physical condition of a plant (Nadeem *et al*., 2020).

Table 4.3. Analysis of variance for the effect of Iron Sulfate and Boric Acid onNOBL.01

Source	DF	SS	MS	F	P
Replication	2	1.47111	0.73556		
Treatment	5	1.27111	0.25422	0.36	0.8645NS
Error	10	7.06222	0.70622		
Total	17	9.80444			

**=Highly Significant (P<0.01); *=Significant (P<0.05); NS=Non-Significant

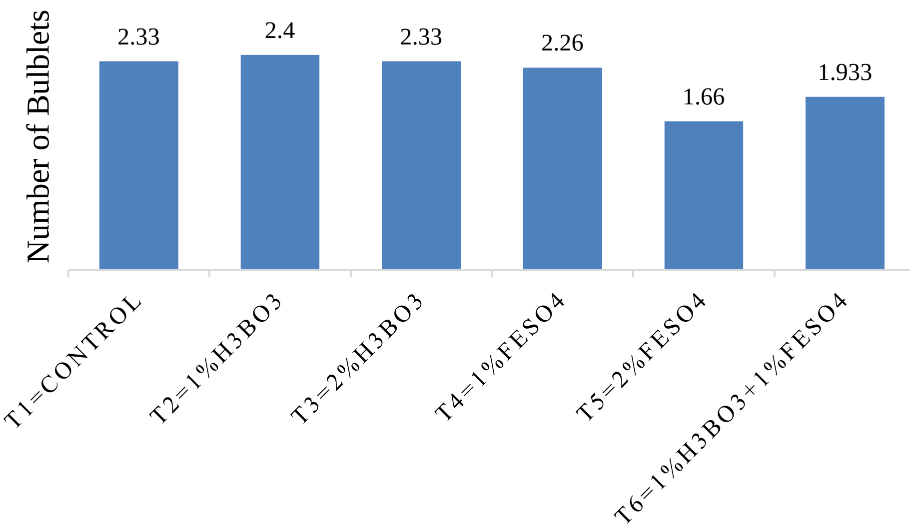

Figure 3. Effect of Iron Sulfate and Boric Acid on number of bulblets

LARGEST BULB WEIGHT:

The data collected from the treatment of Boric Acid and Iron sulfate showed significant difference while determining the weight of largest bulbs. The data was statistically analyzed for each bulb produced by Dutch Iris plant and ANOVA applied was to find out the effect of different concentrations of Iron Sulfate and Boric Acid. Table 4.4 showed that the effect of foliar application was significant (P<0.05). The mean values significantly affected bulb weight with different levels of Boric Acid. Maximum bulb weight(28.6gm) was observed in treatment $T_2$with foliar application of (1 percent Boric Acid). (Manna, 2013) initiate that boron trigger considerable enlargement in individual bulb weight, bulb diameter, marketable and total yield, which is in high-quality contract with the outcome of the current investigation. Bulb weight (57.1 g) and Neck thickness (1.39 cm) were produced by 0.5 percent boron treatment crucial to comprehensive departing marketable (25. 9t h-1) and overall yield (30.7t h-1) of onion. In addition, equivalent cost was attained (Manna and Maity, 2016). Hussain and Ahmad (2018) obtainable and inclusive sight for corm weight selected extensive differences among treatments. The corms of gladiolus furthermost weight beneath joint purpose of micronutrients appreciable than the corm weight produced in other treatments.

Table 4.4. Analysis of variance for the effect of Iron Sulfate and Boric Acid on LBW.

Source	DF	SS	MS	F	P
Replication	2	82.938	41.4689		
Treatment	5	38.224	7.6449	1.58	0.04*
Error	10	48.289	4.8289		
Total	17	169.451			

**=Highly Significant (P<0.01); *=Significant (P<0.05), NS=Non-Significant

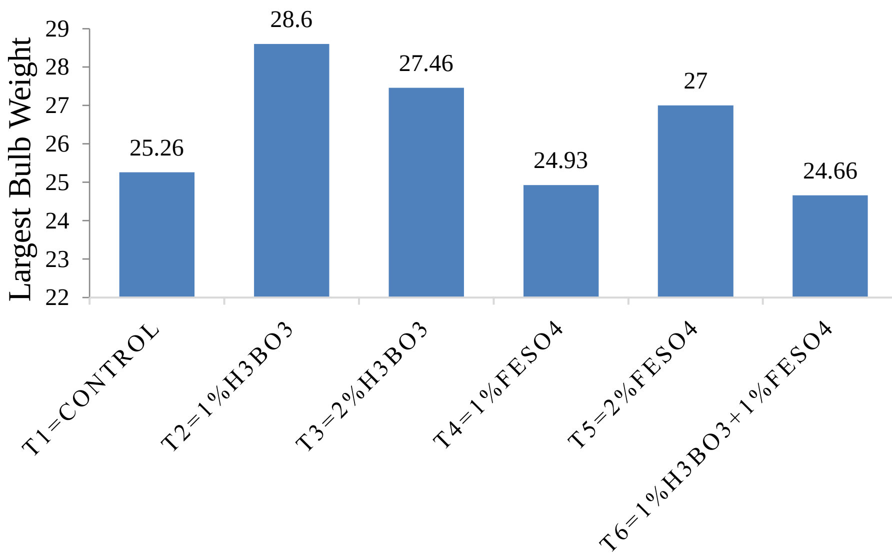

Figure 4. Effect of Iron Sulfate and Boric Acid on largest bulb weight

SMALLESTBULB WEIGHT:

The data was statistically analyzed for smallest bulb weight and statistically analyzed for each smallest bulblet produced by Dutch Iris plant and ANOVA applied was to find out the effect of different concentrations of Iron Sulfate and Boric Acid. Table (4.5) showed that the effect of foliar application was non-significant (P<0.05). The mean values significantly affected bulb weight with different levels of Boric Acid and Iron Sulfate. Maximum bulb weight(4.66gm) was observed in treatment $T_2$with foliar application of (1 percent Boric Acid). (Singh et al., 2012) affirmed that foliar application of Zn (0.50 percent) better weight of corms in gladiolus. Treatment of bothH_3BO_3 (0, 5, 10 or 20 ppm) or $ZnSO_4$ (0, 0.15, 0.30 or 0.45 percent) any particular or in various blends as foliar spray also drastically enlarged both fresh and dry weight of bulbs in Iris (Khalifa et al., 2011).Hussain and Ahmad (2018) offered a complete sight for corm weight nominated significant differences among treatments. The corms of gladiolus further most weight beneath joint purpose of micronutrients appreciably elevated than the corm weight produced in other treatments. The related outcome also developed the conclusion (Ahmed et al., 2002; Halder et al., 2007) who find foliar application of variance micronutrients improved corm weight in gladiolus.

Table 4.5. Analysis of variance for the effect of Iron Sulfate and Boric Acid on SBW

Source	DF	SS	MS	F	P
Replication	2	3.0144	1.50722		
Treatment	5	9.9361	1.98722	1.29	0.3417NS
Error	10	15.4189	1.54189		
Total	17	28.3694			

**=Highly Significant (P<0.01); *=Significant (P<0.05); NS=Non-Significant

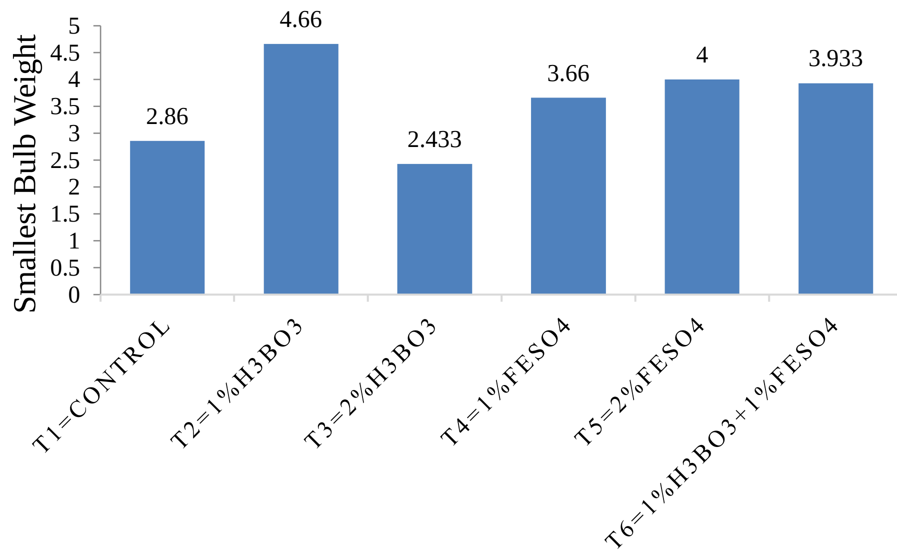

Figure 5. Effect of Iron Sulfate and Boric Acid on smallest bulb weight

V CONCLUSION AND RECOMMENDATION

It was concluded from the above results discussed that Iron Sulfate ($FeSO_4$) and Boric Acid (H_3BO_3) have significant effect on the Bulbs of Dutch Iris. From these results it was also noted that balance amount of Boric Acid (H_3BO_3) and Iron Sulfate ($FeSO_4$) has good effect on Bulbs. Maximum treatments have significantly affected majority of the parameters of bulb quality, but the best result was recorded in T_4 (1% Iron Sulfate). Whereas largest bulb weight was recorded in T_2 (1% Boric Acid). It is recommended from the above results that Iron Sulfate and Boric Acid have a vital role in growth and production of flowering plants.

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