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Effect of micronutrients on growth, flower yield and flower quality of petunia (*Petunia hybrida*) Cv. purple star

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Abstract

The present investigation entitled "Effect of Micronutrients on Growth, Flower Yield and Flower Quality of Petunia (*Petunia hybrida*) cv. Purple star" was carried out during 2019-2020 at research field of Department of Horticulture, Allahabad School of agriculture, SHUATS, Prayagraj. The experiment included ten treatments and three replications. Treatment details were T₀ - (Control), T₁ - (ZNSO₄ @ 0.2%), T₂ - (ZNSO₄ @ 0.4%), T₃ - (ZNSO₄ @ 0.6%), T₄ - (FESO₄ @ 0.2%), T₅ - (FESO₄ @ 0.4%), T₆ - (FESO₄ @ 0.6%), T₇ - (CUSO₄ @ 0.2%), T₈ - (CUSO₄ @ 0.4%), T₉ - (CUSO₄ @ 0.6%). It was concluded that application of ZNSO₄ @ 0.6% in treatment T₃ was found to be superior on plant height (23.95 cm), plant spread (72.41 cm), number of branches (22.13), number of leaves (561.75), number of days required for 1st bud emergence from transplanting (21.92), number of days required for 1st flower opening (30.83), and application of ZNSO₄ @ 0.2% in treatment T₁ found best in terms of flower stalk length (6.78 cm), and flower length (7.70 cm) and application of ZNSO₄ @ 0.6% in Treatment T₃ found superior in terms of fresh weight of flower (1.16 g), dry weight of flower (0.89 g), number of flowers per plant (106.47), flower yield per plant (122.35 g), flower yield per plot (489.40 g), flower yield per hectare (4.89 t) was observed as compared to T₀- Control.

Keywords: Micronutrients, ZNSO₄, FESO₄, CUSO₄, petunia (*Petunia hybrida*) etc.

Introduction

Petunia (*petunia hybrida*) is a winter annual flowering crop belongs to the family Solanaceae, and flowers vary from i.e. single to double in different colours like white, cream, pink, purple, magenta, mauve, salmon or bicoloured are available. Petunia is open pollinated winter flowering annual crop. The height of plant varies from 50-70 cm. the seedlings are transplanted in first week of November at 45 cm x 45 cm distance. Seeds are ready for harvesting from April to mid june. Harvest the pods as they began drying otherwise shattering will occur. It is native of south America and is very popular in Indian gardens due to its floriferous and hardy nature.

Petunia is commonly grown as bedding, pots, hanging baskets, window boxes, rockery and for mass planting. Plants grow about 30 to 40 cm and have spreading habit with trailing branches. Leaves are small, round and thick. The flowers have five petals which are joined and are trumpet shaped.

The single bedding petunia is one of the best and most valuable bedding ornamental flowers, as this has a long flowering season under favourable conditions. It flowers best as the hot weather approaches and can be continued till the rains in the hills. Petunias are also good for borders, mass planting edgings, rock gardens (especially the dwarf types), window boxes, and hanging basket (balcony type) and pots. Petunia is also good for vase decoration as cut flowers and when grown in mass under the shrubs they display a striking effect.

Materials and Methods

The Experiment was conducted in Randomized Block Design (RBD) with 10 treatments of Micronutrients i.e. Zinc Sulphate (ZNSO₄), Ferrous Sulphate (FESO₄) and Copper Sulphate (CUSO₄) with three replications in the Departmental Research field of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during November 2019 to March 2020. Total number of treatments were ten viz. T₀ - (Control), T₁ - (ZNSO₄ @ 0.2%), T₂ - (ZNSO₄ @ 0.4%), T₃ - (ZNSO₄ @ 0.6%), T₄ - (FESO₄ @ 0.2%), T₅ - (FESO₄ @ 0.4%), T₆ - (FESO₄ @ 0.6%), T₇ - (CUSO₄ @ 0.2%), T₈ - (CUSO₄ @ 0.4%), T₉ - (CUSO₄ @ 0.6%)

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Climatic condition in the experimental site

The area of Prayagraj district comes under subtropical belt in the South east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46°C - 48°C and seldom falls as low as 4°C - 5°C. The relative humidity ranged between 20-94 percent. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

Results and Discussion

The present investigation entitled "Effect of Micronutrients on Growth, Flower Yield and Flower Quality of *Petunia hybrida* cv. Purple Star" was carried out during November 2019 to March 2020 in Departmental Research Field of Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P) India. The results of the present investigation, regarding the effect of Micronutrients on growth, flower yield and flower quality of *Petunia*, have been discussed and interpreted in the light of previous research work done in India and abroad. The experiment was conducted in Randomized block design with 10 treatments, and three replications.

The results of the experiment are summarized below.

A. Growth Parameters

Among all the treatments shown in Table -1, the maximum plant height (23.95 cm) was recorded in treatment T₃- ZNSO₄ @ 0.6% followed by T₁- ZNSO₄ @ 0.2%. (22.73 cm). Minimum plant height (17.45cm) was recorded in treatment T₀ control. The maximum plant spread (72.41 cm) was recorded in treatment T₃-ZNSO₄ @ 0.6% followed by T₁-ZNSO₄ @ 0.2% (70.21 cm). Minimum plant spread (58.59 cm) was recorded in treatment T₀ control. The maximum Number of branch per plant (22.13) was recorded in treatment T₃-ZNSO₄ @ 0.6% followed by T₁- ZNSO₄ @ 0.2% (21.42). Minimum Number of branch per plant (14.44) was recorded in treatment T₀ control. The maximum Number of leaves per plant (561.75) was recorded in treatment T₃-ZNSO₄ @ 0.6% followed by T₁- ZNSO₄ @ 0.2% (542.12). Minimum Number of leaves per plant (381.63) was recorded in treatment T₀ control.

B. Floral Parameters

Micronutrients significantly affected the number of days required for first flower bud emergence from transplanting. However, it was seen that minimum days (21.92) were taken by treatment T₃-ZNSO₄ @ 0.6% which was remarkably better than T₈- CUSO₄@ 0.4% (34.42 days). The increase in the number of days was seen between the various treatments. Treatment T₄ - FESO₄ @ 0.2%, (24.00 days), T₇- CUSO₄ @ 0.2%. (26.25 days), T₁ -ZNSO₄ @ 0.2% (27.58 days), T₆- FESO₄ @ 0.6% (29.42 days) T₅ - FESO₄ @ 0.4% (30.67 days) were and control T₀ - Control (37.58 days).

Micronutrients significantly affected the number of days required for first flower opening. However, it was seen that minimum days (30.83) were taken by treatment T₃-ZNSO₄ @ 0.6% which was remarkably better than T₈- CUSO₄ @ 0.4% (42.50 days). The increase in the number of days was seen between the various treatments. Treatment T₄ - FESO₄ @ 0.2%, (32.25 days), T₇- CUSO₄ @ 0.2%. (35.33 days), T₁ - ZNSO₄ @ 0.2% (36.25 days), T₆ - FESO₄ @ 0.6% (37.25 days) T₅ - FESO₄ @ 0.4% (38.25 days) were and control T₀ - Control (49.25 days).

It is evident from the data that flower stalk length (cm) of flower was significantly affected by Micronutrients. The highest flower stalk length (cm) was found in treatment T₁-ZNSO₄ @ 0.2% (6.78 cm) followed by T₃- ZNSO₄ @ 0.6% (6.72 cm), T₂- ZNSO₄ @ 0.4% (6.62 cm) and T₇ - CUSO₄ (6.59 cm). Lowest flower stalk length (cm) was found in treatment T₀- (4.68 cm) control.

It is evident from the data that fresh weight of flower was significantly affected by Micronutrients. The highest fresh weight was found in treatment T₃- ZNSO₄ @ 0.6% (1.16 g) followed by T₁-ZNSO₄ @ 0.2% (1.07 g), T₂- ZNSO₄ @ 0.4%(1.05 g) and T₇- CUSO₄ (1.03 g). Lowest fresh weight was found in treatment T₀- (0.78 g) control.

It is evident from the data that Dry weight of flower was significantly affected by Micronutrients. The highest Dry weight was found in treatment T₃- ZNSO₄ @ 0.6% (0.89 g) followed by T₁- ZNSO₄ @ 0.2% (0.86 g), T₂- ZNSO₄ @ 0.4% (0.83 g) and T₇ - CUSO₄ (0.80 g). Lowest dry weight was found in treatment T₀- (0.61 g) control.

C. Quality Parameters

significant use of treatment T₃- ZNSO₄ @ 0.6% produced flowers of larger size i.e. Diameter of flower (9.26 cm), other treatments which produced significant results over control were T₁-ZNSO₄ @ 0.2% (9.05 cm), T₂-ZNSO₄ @ 0.4% (8.96 cm), T₈-CUSO₄ @ 0.4%. (8.88cm) and diameter of flower (8.42 cm) was found minimum in treatment T₀ (Control). It is evident from the data that flower length (cm) of flower was significantly affected by Micronutrients. The highest flower length (cm) was found in treatment T₁- ZNSO₄ @ 0.2% (7.70 cm) followed by T₃- ZNSO₄ @ 0.6% (7.47 cm), T₂- ZNSO₄ @ 0.4% (6.98 cm) and T₇ - CUSO₄ (6.79 cm). Lowest flower length (cm) was found in treatment T₀- (5.06 cm) control.



Fig 1: During the Field Visit by Advisor Dr. V.M. Prasad sir

D. Yield Parameters

Micronutrients had significant influence on total number of flower per plant. Significantly highest number of flowers plant was recorded in treatment T₃-ZNSO₄ @ 0.6% (106.47) compared to other treatments. This treatment was followed by T₁-ZNSO₄ @ 0.2%. (94.63), T₂-ZNSO₄ @ 0.4% (92.71), T₇-CUSO₄ @ 0.2% (89.62) and T₄-FESO₄ @ 0.2% (88.40) which were superior over control. Lowest number of flowers (72.42) was observed in treatment T₀ Control. Significantly highest yield of flower per plant (g) was recorded in treatment T₃-ZNSO₄ @ 0.6% (122.35 g) than all other treatment. This treatment was followed by T₁-ZNSO₄ @ 0.2% (104.53 g), T₂-ZNSO₄ @ 0.4%. (98.75 g), T₇-CUSO₄ @ 0.2% (91.74 g) and minimum flower yield (57.43g) was obtained in treatment T₀ Control. Significantly highest yield of flower per plot (g) was recorded in treatment T₃-ZNSO₄ @ 0.6% (489.40 g) than all other treatment. This treatment was followed by T₁-ZNSO₄ @

0.2% (418.11 g), T₂- ZNSO₄ @ 0.4%. (394.98 g), T₇-CUSO₄ @ 0.2% (366.97 g) and minimum flower yield (229.72 g) was obtained in treatment T₀-Control. Significantly highest yield of flower per hectare (t) was recorded in treatment T₃-ZNSO₄

@ 0.6% (4.89 t) than all other treatment. This treatment was followed by T₁-ZNSO₄ @ 0.2% (4.18 t), T₂- ZNSO₄ @ 0.4% (3.95 t), T₇-CUSO₄ @ 0.2% (3.67 t) and minimum flower yield (2.30 t) was obtained in treatment T₀-Control.

Table 1: Effect of Micronutrients on Plant height (cm), Plant spread (cm), Number of branches per plant, and Number of leaves per plant of Petunia cv. Purple Star

| Treatment symbols | Treatment Combination | Plant height (cm) | Plant spread (cm) | Number of branches per plant | Number of leaves per plant |
|-------------------|--------------------------|-------------------|-------------------|------------------------------|----------------------------|
| | | 120 DAT | 120 DAT | 120 DAT | 120 DAT |
| T ₀ | Control | 17.45 | 58.59 | 14.44 | 381.63 |
| T ₁ | ZNSO ₄ @ 0.2% | 22.73 | 70.21 | 21.42 | 542.12 |
| T ₂ | ZNSO ₄ @ 0.4% | 21.64 | 69.39 | 20.32 | 523.22 |
| T ₃ | ZNSO ₄ @ 0.6% | 23.95 | 72.41 | 22.13 | 561.75 |
| T ₄ | FESO ₄ @ 0.2% | 20.65 | 66.63 | 19.23 | 516.59 |
| T ₅ | FESO ₄ @ 0.4% | 18.12 | 61.72 | 15.75 | 434.73 |
| T ₆ | FESO ₄ @ 0.6% | 19.85 | 64.35 | 17.46 | 492.37 |
| T ₇ | CUSO ₄ @ 0.2% | 20.97 | 68.42 | 19.72 | 509.72 |
| T ₈ | CUSO ₄ @ 0.4% | 20.23 | 65.53 | 18.33 | 513.42 |
| T ₉ | CUSO ₄ @ 0.6% | 19.45 | 62.53 | 16.85 | 462.65 |
| | F-test | S | S | S | S |
| | S.Ed (+) | 0.03 | 0.10 | 0.01 | 0.01 |
| | CD at 5% | 0.06 | 0.22 | 0.03 | 0.02 |

Table 2: Effect of Micronutrients on No. of days for first flower bud emergence, No. of days for 1st flower opening, fresh weight (gm), Dry weight (gm), Flower stalk length (cm), Flower length (cm), and Diameter of flower (cm) of Petunia cv. Purple Star

| Treatments symbols | Treatment Combination | No. of days for first flower bud emergence | No. of days required for 1 st Flower Opening | Fresh weight (gm) | Dry weight (gm) | Flower stalk length (cm) | Flower length (cm) | Diameter of flower (cm) |
|--------------------|--------------------------|--|---|-------------------|-----------------|--------------------------|--------------------|-------------------------|
| T ₀ | Control | 37.58 | 49.25 | 0.86 | 0.61 | 4.68 | 5.06 | 8.42 |
| T ₁ | ZNSO ₄ @ 0.2% | 27.58 | 36.25 | 1.07 | 0.86 | 6.78 | 7.70 | 9.05 |
| T ₂ | ZNSO ₄ @ 0.4% | 32.08 | 41.25 | 1.05 | 0.83 | 6.62 | 6.98 | 8.96 |
| T ₃ | ZNSO ₄ @ 0.6% | 21.92 | 30.83 | 1.16 | 0.89 | 6.72 | 7.47 | 9.26 |
| T ₄ | FESO ₄ @ 0.2% | 24.00 | 32.25 | 1.01 | 0.76 | 6.52 | 6.59 | 8.77 |
| T ₅ | FESO ₄ @ 0.4% | 30.67 | 38.25 | 0.91 | 0.65 | 6.38 | 5.48 | 8.64 |
| T ₆ | FESO ₄ @ 0.6% | 29.42 | 37.25 | 0.97 | 0.71 | 6.24 | 6.34 | 8.82 |
| T ₇ | CUSO ₄ @ 0.2% | 26.25 | 35.33 | 1.03 | 0.80 | 6.59 | 6.79 | 8.79 |
| T ₈ | CUSO ₄ @ 0.4% | 34.42 | 42.50 | 0.99 | 0.73 | 5.44 | 6.41 | 8.88 |
| T ₉ | CUSO ₄ @ 0.6% | 31.58 | 39.50 | 0.95 | 0.70 | 5.93 | 6.04 | 8.73 |
| | F-test | S | S | S | S | S | S | S |
| | S.Ed(±) | 0.15 | 0.22 | 0.002 | 0.001 | 0.01 | 0.02 | 0.01 |
| | C D 5% | 0.31 | 0.46 | 0.003 | 0.003 | 0.02 | 0.03 | 0.02 |

Table 3: Effect of Micronutrients on Diameter of flower(cm), Number of flowers per plant, Flower yield per plant (g), Flower yield per plot (g), Flower yield per ha (t) and Benefit cost Ratio of Petunia cv. Purple Star

| Treatments symbols | Treatment combination | Number of flowers per plant | Flower yield Per plant (g) | Flower yield Per plot (g) | Flower yield Per ha (t) | Benefit Cost Ratio |
|--------------------|--------------------------|-----------------------------|----------------------------|---------------------------|-------------------------|--------------------|
| T ₀ | Control | 72.42 | 57.43 | 229.72 | 2.30 | 1.06 |
| T ₁ | ZNSO ₄ @ 0.2% | 94.63 | 104.53 | 418.11 | 4.18 | 1.89 |
| T ₂ | ZNSO ₄ @ 0.4% | 92.71 | 98.75 | 394.98 | 3.95 | 1.76 |
| T ₃ | ZNSO ₄ @ 0.6% | 106.47 | 122.35 | 489.40 | 4.89 | 2.16 |
| T ₄ | FESO ₄ @ 0.2% | 88.40 | 87.30 | 349.19 | 3.49 | 1.58 |
| T ₅ | FESO ₄ @ 0.4% | 80.34 | 69.73 | 278.91 | 2.79 | 1.25 |
| T ₆ | FESO ₄ @ 0.6% | 83.75 | 76.22 | 304.88 | 3.05 | 1.36 |
| T ₇ | CUSO ₄ @ 0.2% | 89.62 | 91.74 | 366.97 | 3.67 | 1.66 |
| T ₈ | CUSO ₄ @ 0.4% | 84.53 | 81.78 | 327.13 | 3.27 | 1.46 |
| T ₉ | CUSO ₄ @ 0.6% | 82.17 | 74.12 | 296.48 | 2.96 | 1.31 |
| | F-test | S | S | S | S | |
| | S.Ed (±) | 0.03 | 0.03 | 0.12 | 0.002 | |
| | CD at 5% | 0.05 | 0.07 | 0.26 | 0.003 | |

Conclusion

On the basis of present investigation it is concluded that the application of treatment T₃-ZNSO₄ @ 0.6% found best in terms of Growth, Flower Quality and Flower Yield, Economics of Treatments, Gross return, net profit and Maximum Cost Benefit ratio (1:2.16) of Petunia followed by T₁- ZNSO₄ @ 0.2%. In terms of Flower stalk length (cm) and

Flower length (cm) application of treatment T₁-ZNSO₄ @ 0.2% found best.

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