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Physiological roles of nano fertilizer and thiamine (B1) on some growth and flowering of Petunia plant (*Petunia hybrida* L.)

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Abstract

The study was carried out at the Lath house located in the Department of Horticulture and Landscape Design, University of Kirkuk, Agricultural Research and Experiments Station, Al-Sayada. To assess the impact of two parameters, namely the foliar application of Nano fertilizer with varying concentrations of macro and micro components (0, 1.5, and 3) g, the study was conducted from October 23, 2022, to June 4, 2023. The doses of L^{-1} and thiamine are 0 mg, 150 mg, and 300 mg. The experiment on growth and flowering attributes was planned using a randomized complete block design (RCBD). The findings were analyzed using the statistical tool SAS (2005). The Dunkin' test was conducted at a significance level of 0.05. The findings revealed that the application of Nano fertilizer, at a concentration of 3 g. L^{-1}, resulted in an increase in plant height by 18.6 cm. Conversely, the use of thiamine led to a significant reduction in plant height when the concentration was increased to 300 mg. The length of L^{-1} is 14.16 cm. The study revealed that the combination between Nano fertilizer, which contains both macro and micro components, and thiamine had a notable impact at a concentration of 3
g. Concentrations of L^{-1} thiamine at 0.0 and 300 mg L^{-1} resulted in significant increases in plant height (24.3 cm) and leaf area (1459 cm^2), respectively. Additionally, the plants exhibited an early blooming date at a dosage of 1.5 g. The treatment with L^{-1} and 300 mg L^{-1} (27.67) resulted in a delay in blooming date (56.67) compared to the plant control.

Keywords: Physiological, nano, fertilizer, petunia, *Petunia hybrida* L

Introduction

Petunia hybrida L. is a winter herbaceous annual plant that is native to South America and belongs to the Solanaceae family. The bell-shaped flowers, also known as trumpet-shaped blossoms, appear during the spring and summer seasons. The flowers of Petunia that grow in gardens are hybrid varieties resulting from the crossbreeding of *Petunia axillaris* and *Petunia integrifolia*. These flowers exhibit a range of colors including pink, red, violet, and blue [8]. There exist several variations of them that exhibit variations in their forms and dimensions. The genus name Petunia is derived from the Greek word "Petun," which translates as smoke plant. This name may be attributed to the resemblance between these two plants in terms of their exterior look [4]. Vitamins are important chemicals that control growth and

can be found in small amounts, controlling many growth processes, such as biological energy pathways in plants. One part of the pentose phosphate cycle they help is keto decarboxylation. They also help make carbohydrates, which are also known as thiamine [6], by reducing and synthesising enzymes. Thiamine is one of the growth regulators that stimulates cell growth and division, i.e., works to improve plant growth [11], Concentrations of thiamine abound in highly effective areas of the plant. It is believed that this vitamin is formed in the leaves and depends on light in its composition, as required by the roots for their growth [10]. Nanotechnology is being used more and more in agriculture to improve the effectiveness of mineral fertilizers. It does this by increasing the surface area, which in turn increases the reaction's surface area and speed. This makes these (Nano) fertilizers more effective than traditional fertilizers. Some nutrients have been mixed into different Nanoparticles to have a significant effect that makes it easier for plants to absorb them [2].

Nano fertilizer technology is the most widespread and is used for its positive effect on improving plant growth. [7]. Many studies, such as those by [1], have shown the importance of saffron (*Crocus sativus* L.). The study looked at what happens to the petunia plant's body when Nano fertilizers with macro and micro elements and thiamine are put on the plant's leaves. They looked at how this affects the plant's growth and flowering.

Materials and Methods

The study was carried out at the Lath house located in the Department of Horticulture and Landscape Design, University of Kirkuk, Agricultural Research and Experiments Station, Al-Sayada. The research was done from October 23, 2022, until June 4, 2023. The seedling pots were filled with growth material composed of a 2:1 ratio of sand to peat moss. On October 23, 2022, the seedlings were transferred from 10 cm plastic pots to bigger 20 cm plastic pots. The media pots have a capacity ranging from 6.5 kg. They are subjected to a weekly preventative regimen that includes the application of the fungicide Rasha and the insecticide Tagros FLASH. The plants were protected from fungal and insect infections by applying a 10% EC alfasipermethrin spray to the leaves, following the recommendation of (3). The seedlings were treated with Nano fertilizer on three occasions. The initial application took place on October 27, 2022, when the seedlings had reached the third leaf stage. The subsequent applications were administered at monthly intervals. The plants were additionally treated with thiamine on three occasions. The first application occurred one week after the Nano fertilizer spray, followed by a second application one week after the first one. The experimental setting utilized the R.C.B.D. (Randomized Completely Block Design) methodology, employing three blocks and nine treatments. The bifurcation processes were monitored as required, and prior to planting, plants were irrigated and soil samples were collected to determine their physical and chemical characteristics, as indicated in the attached table-1. Examined the subsequent characteristics:

1. Plant height (cm).
2. Leaves area (cm^2).
3. The content of total chlorophyll.
4. Flowering date (days).
5. Number of flowers. Plant.

Table 1: Some of physical and chemical properties of the soil before planting

Type of analysis	Standard Unit	Analysis result
EC	$Mmho.cm^{-1}$	0.526
PH		7.1
TDS	mg/kg	336.941
available nitrogen	mg/kg	420.300
available phosphorus	mg/kg	2.333
available potassium	mg/kg	127.038
Organic matter	%	1.656
Calcium	mg/kg	64.128
Magnesium	mg/kg	19.456
Tissue		Sandy
Clay	%	8
Silt	%	2
Sand	%	90

*****The soil was analyzed in the soil laboratory of the Kirkuk Agriculture Directorate

Results and Discussion

Plant height (cm): Figure (1-a) shows that spraying plants with Nano fertilizer containing macro and micro elements increased their height significantly when the concentration was 3 $g.L^{-1}$. The plants grew 18.6 cm, which is a significant difference from the control, which only grew 13.3 cm. This might be because of the Nano-effect of the macro and micro elements on the importance of the Nano fertilizer used and its physiological role in affecting the vital processes within the plant. This had a positive effect on the quality of the plants and was due to the properties of Nano fertilizers, such as their small size and large leaf area, which increases the absorption surface, makes photosynthesis more efficient, and boosts plant growth [5]. The thiamine figure (1-b) showed that it had a significant effect on the plant's height decreased to 14.16 cm, when sprayed at a concentration of 300 $mg.L^{-1}$, compared with control (18.9 cm), and this result doesn't match what it said it would. As shown in Figure (1- c) from [9] study of the *Pelargonium hortorum* L. plant, interaction, the plants grew 24.3 cm taller after being sprayed with 3 $g.L^{-1}$ of Nano fertilizer containing macro- and micro elements and thiamine as a control treatment. It differed significantly with the control treatment of both factors, as it reached a lower height of 11.16 cm. This result is consistent with the results of researchers [9] by studying it on the plant *Pelargonium hortorum* L. and [1]. Studied on the *Crocus sativus* L.

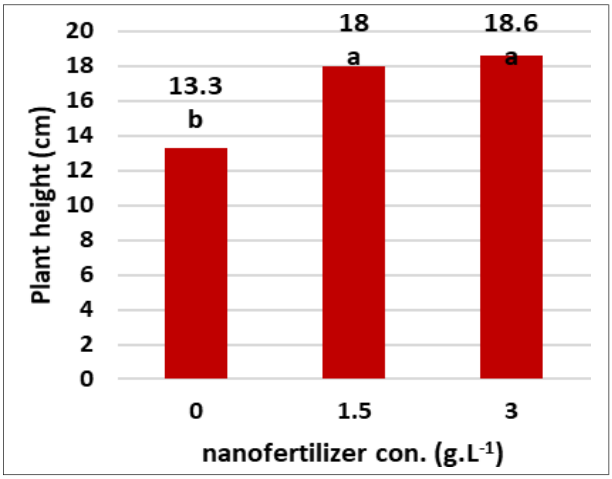


Fig (1-a): Effect of Nano fertilizer on plant height (cm)

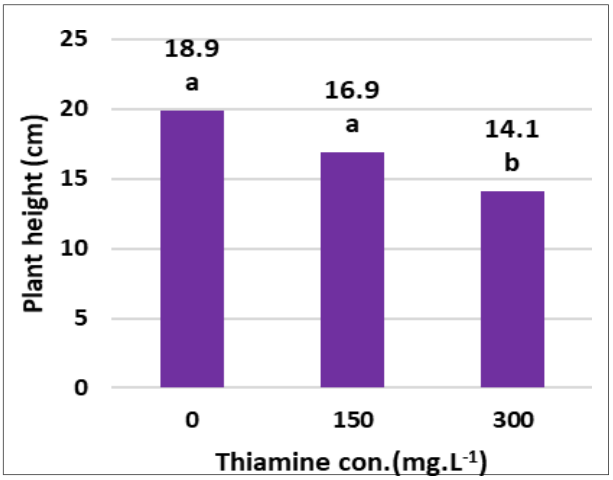


Fig (1-b): Effect of thiamine on plant height (cm)

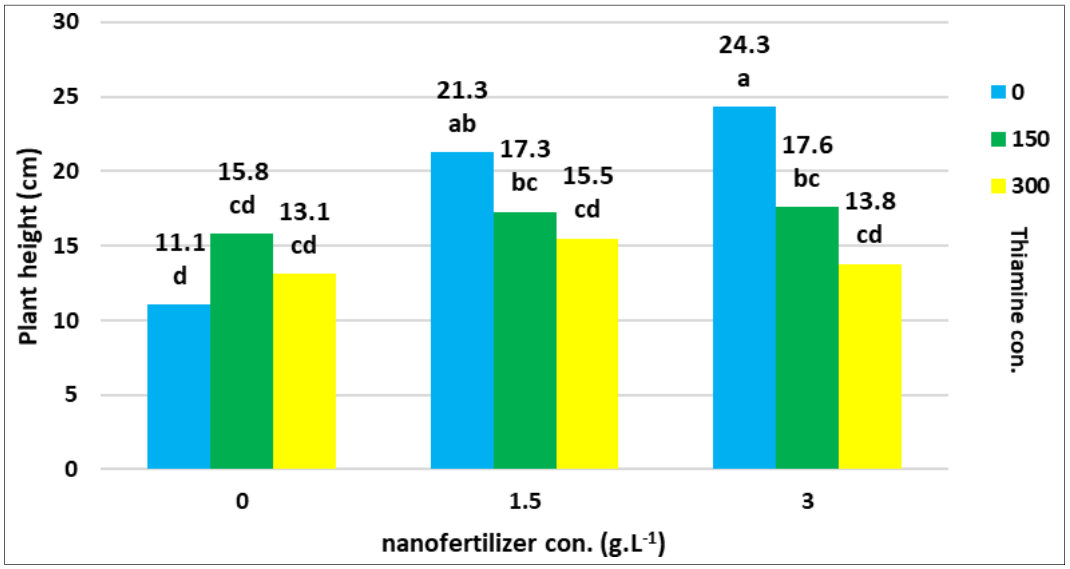


Fig (1-c): Effect of Interaction between Nano fertilizer and Thiamine on Plant height (cm)

* The means with similar letters are not substantially different from each other at a 5% probability level, as determined using the Dunkin' polynomial test.

Fig 1: The Effect of Nano fertilizer of macro- and micro elements, thiamine, and their interaction between them on the plant height of

Petunia hybrida L

Leaves area (cm^2)

The data in Figure (2-a) and (2-b) show that both factors do not have a significant effect in the rate leaves area, this result is similar to what the researcher [13] pointed out in his study on the *Rose hybrida* L., Interaction in Figure (2-c) between the two factors shows a significant increasing the rate leaves area and the largest value was recorded at the concentration of 3 $g.L^{-1}$ of Nano fertilizer for macro and micro elements and spraying 300 $mg.L^{-1}$ of thiamine, as it reached 1459 cm^2, and differed significantly from spraying at a concentration of (1.5 $g.L^{-1}$) of Nano fertilizer for macro and micro elements and 300 $mg.L^{-1}$ of Thiamine and amounted to 863 cm^2, this result may be attributed to the

positive effect interfering between the two factors that have been studied and This is consistent with the results referred to by the researchers [12] in his study of the *Iris* sp. plant [1], with his study on the *Crocus sativus* L.

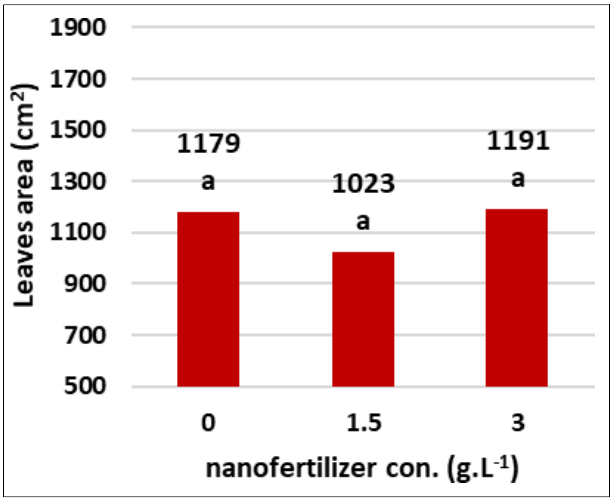


Fig (2-a): Effect of nano fertilizer on Leaves area (cm^2)

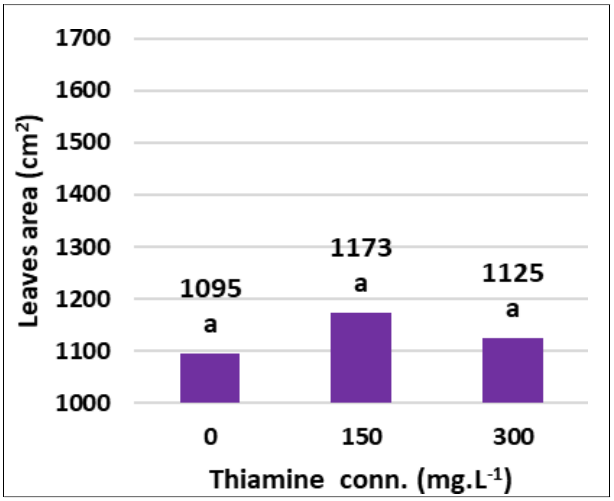


Fig (2-b): Effect of thiamine on Leaves area (cm^2)

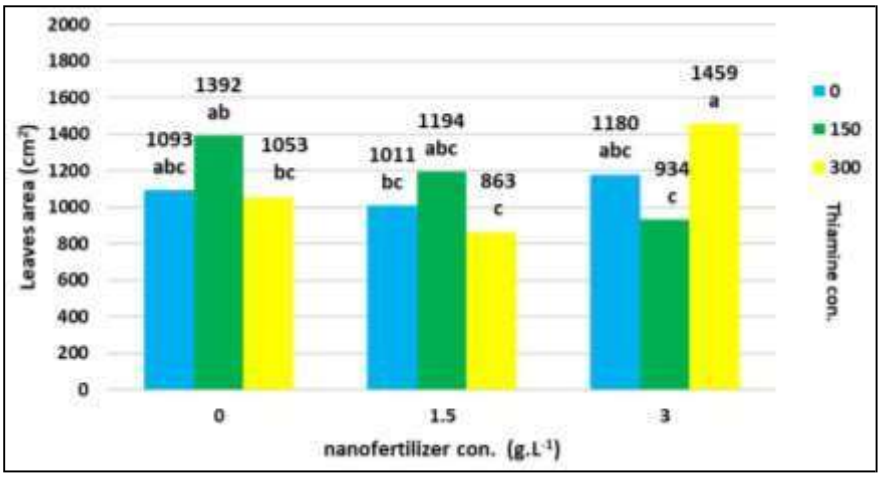


Fig (2-c): Effect of Interaction between Nano fertilizer and Thiamine on Leaves area (cm^2)

*Averages with similar letters do not differ significantly from each other at the 5% probability level according to the Dunkin' polynomial test

Fig 2: The Effect of Nano fertilizer of macro- and microelements, thiamine, and their interaction between them on the Leaves area (cm^2) of *Petunia hybrida* L

The content of total chlorophyll

The data in Figures (3-a), (3-b) and (3-c) did not show any significant differences for both factors studied on the rate of total chlorophyll content of the leaves.

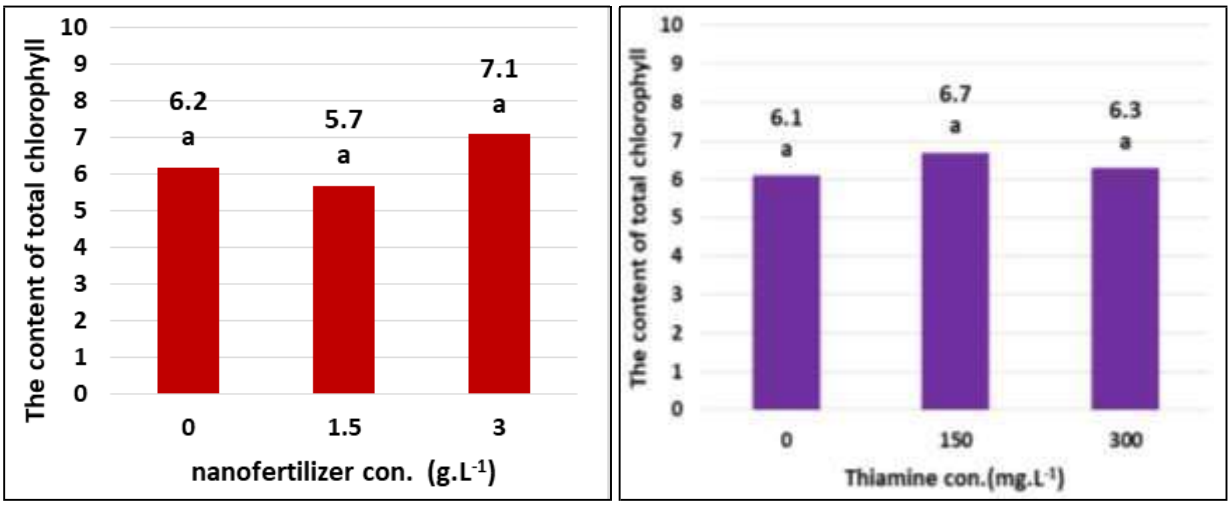


Fig (3-a): Effect of Nano fertilizer on the content of total chlorophyll

Fig (3-b): Effect of thiamine on the content of total chlorophyll

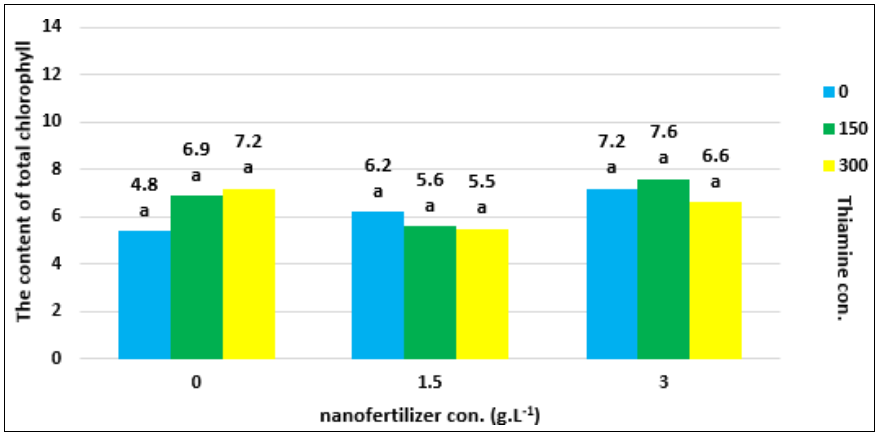


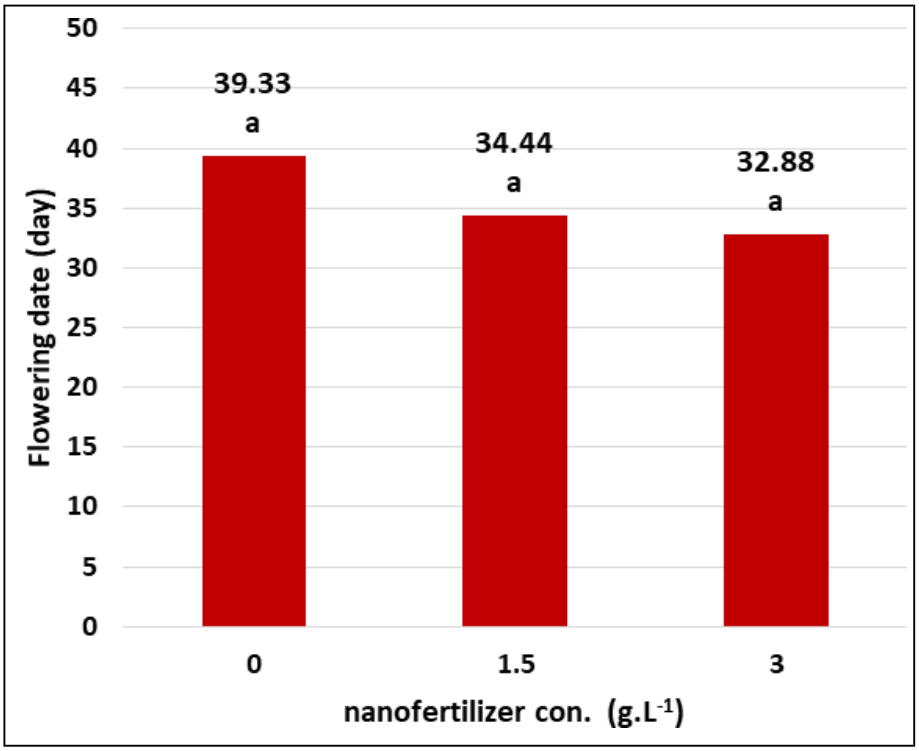
Fig (3-c): Effect of Interaction between Nano fertilizer and Thiamine on content of Total Chlorophyll

*Averages with similar letters do not differ significantly from each other at the 5% probability level according to the Dunkin' polynomial test.

Fig 3: The Effect of Nano fertilizer of macro- and microelements, thiamine, and their interaction between them on the total chlorophyll content of *Petunia hybrida* L

Flowering date (days)

Figures of (4-a) and (4-b) that spraying with both factors did not have any significant effect on the flowering date, while the interaction in Figure (4-c) showed that spraying with Nano fertilizer for macro and micro elements at a concentration of 1.5 g.L^{-1} and 300 mg.L^{-1} of the thiamine was early at the flowering date and took the minimum duration of flowering 27.67 days, compared to the plants control for both factors, which took the longest duration required for flowering 56.67 days, This result may be due to the overlapping effect of both factors, and this result is similar to with the researchers indicated as [1], in his study on the saffron plant *Crocus sativus* L. and [12] in his study of *Iris* sp. plant.



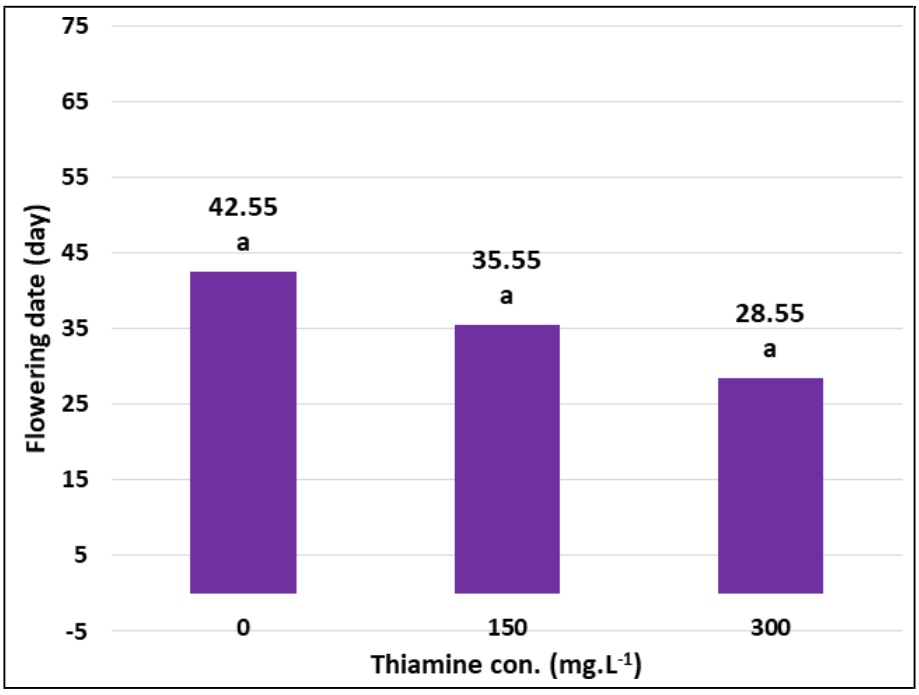


Fig (4-a): Effect of Nano fertilizer on flowering date (day)

Fig (4-b): Effect of thiamine on flowering date (day)

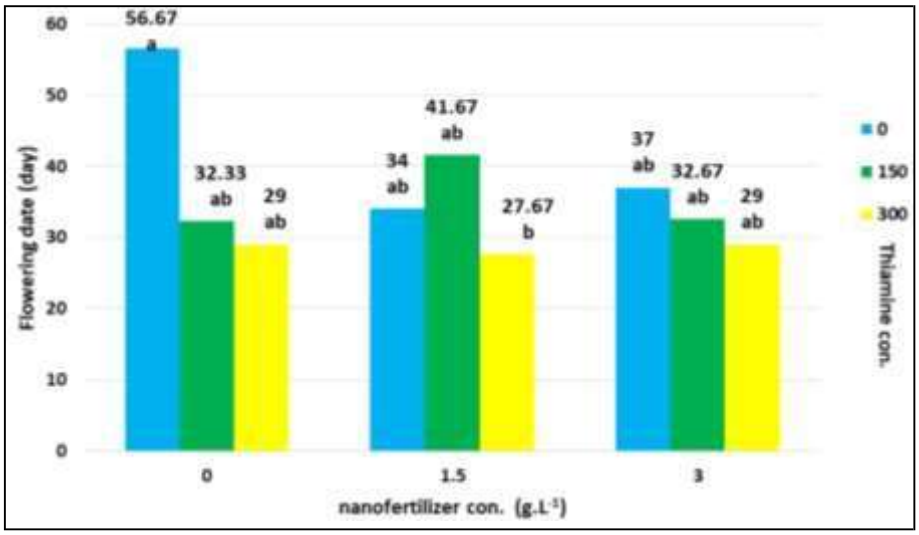


Fig (4-c): Effect of interaction between Nano fertilizer and thiamine on flowering date (day)

*Averages with similar letters do not differ significantly at the 5% probability level according to the Dunkin' polynomial test.

Fig 4: The effect of Nano fertilizer of macro- and microelements and thiamine, their interaction between them on the flowering date of

Petunia hybrida L

Number of flowers. Plant

The data in figures (5-a), (5-b) and (5-c) show an increase in the number of flowers. But it is not significant in the rate number of flowers.

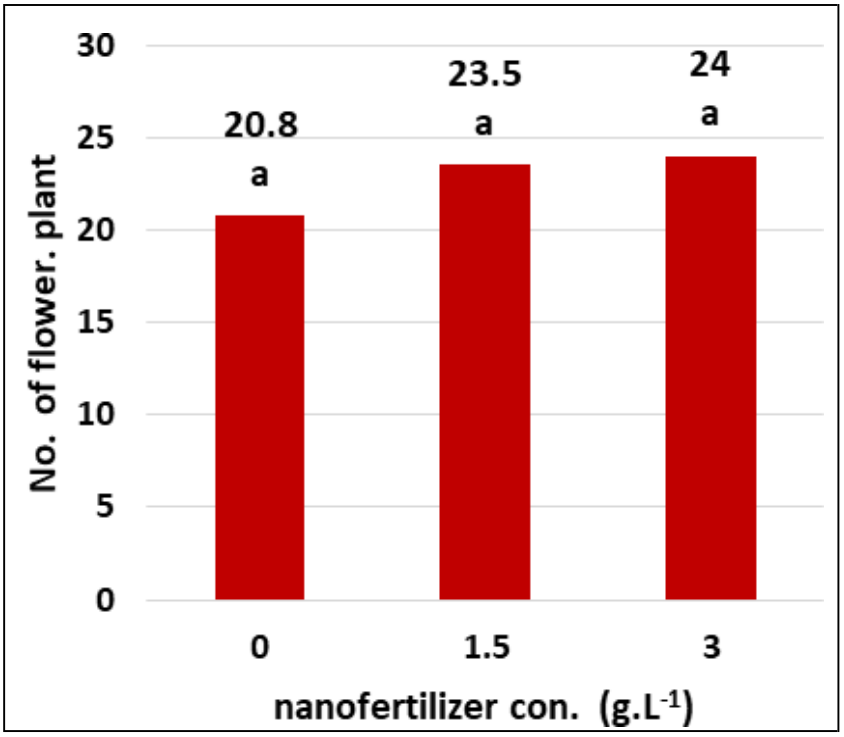


Fig 5-a: Effect of Nano fertilizer on the number

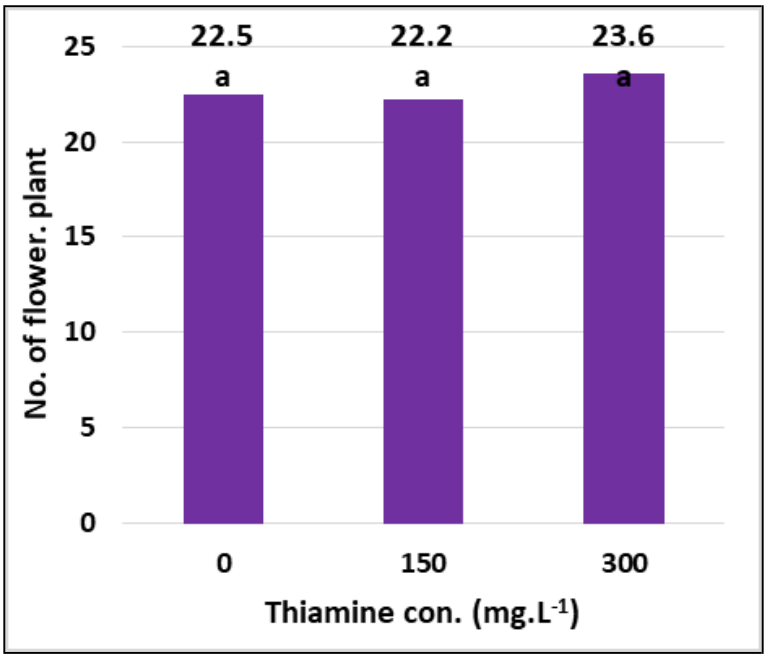


Fig 5-b: Effect of Thiamine on the number of flowers of flowers

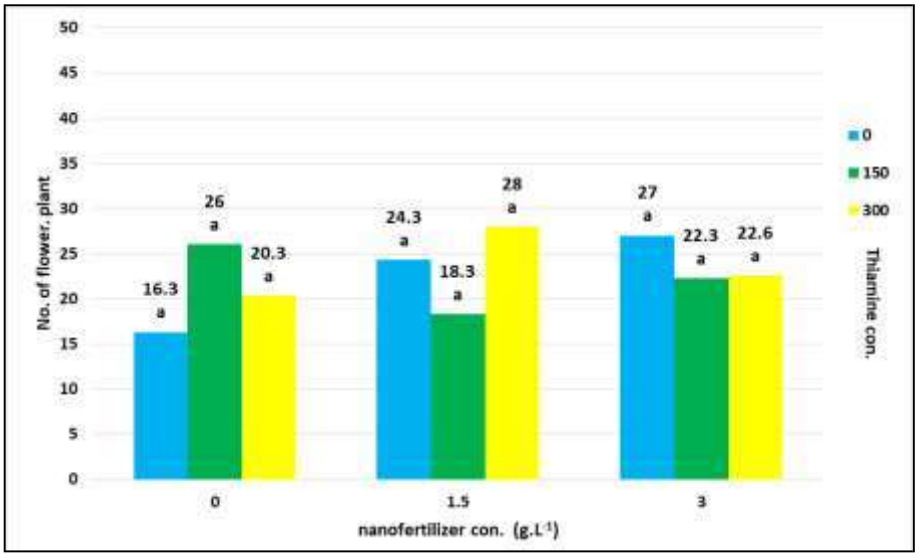


Fig 5-c: Effect of interaction between Nano fertilizer and thiamine on the number of flowers

*Averages with similar letters do not differ significantly at the 5% probability level according to the Dunkin' polynomial test.

Fig 5: The effect of Nano fertilizer of macro- and micro elements and thiamine, the interaction between them on the number of flowers of

Petunia hybrida L

Conclusion

The administration of Nano fertilizer by foliar spraying resulted in a moderate enhancement of growth and blooming characteristics, while the increase was not statistically significant. Thiamine (B1) had a notable impact on reducing plant height when the dosage was increased to 300 $mg.L^{-1}$. However, no significant influence was observed on other

attributes that were investigated. The interaction between two elements had a notable impact on enhancing some traits that were being examined during the initial stages of blooming.

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