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# Flowering Production of *Tagetes Patula* as Affected by Maleic Hydrazide and Paclobutrazol

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## ABSTRACT

During two consecutive growing seasons of 2022 and 2023, in the Floriculture Nursery, Department of Horticulture, Faculty of Agriculture, Minia University, this research was under taken to examine the impact of paclobutrazol and maleic hydrazide on vegetative growth (plant height and number of branches) and flowering production per cut and per season (flower diameter, flower stalk length, flower yield and flower fresh and dry weights) of *Tagetes patula* plant.

Spraying plants with all concentrations of both retardants (maleic hydrazide and paclobutrazol) led to significant reduction of plant height and significantly increased branches number of French marigold plants. In the same time, all above mentioned flowering traits were increased by increasing the concentration of maleic hydrazide and paclobutrazol, except flower stalk length, which was decreased in both seasons. In most cases, the fourth cut was the best in this concern.

**KEYWORDS:** *Tagetes patula*, Growth characters, Flowers production, Maleic Hydrazide, Paclobutrazol

## 1. INTRODUCTION

Asteraceae member *Tagetes patula* L. is suggested for use in home gardens as a cut flower, potted plant, and other uses. Potted flowering plants are needed in the local market for landscaping garden enhancement, garlands, and interior decorating (Bown, 1995 and Ogbu *et al*., 2021).

Nowadays, a variety of chemicals are being tried to regulate the development and flowering of ornamental plants in an effort to create compact plants and to delay or extend the pace at which they produce flowers within the allotted period. Maleic hydrazide reduces growth through preventing cell division but not cell enlargement (Kasem and Abd El-Baset,

2015; Malik *et al*. 2017; Karki *et al*., 2021 and Pal *et al*., 2021).

A plant growth regulator belonging to the triazole family, paclobutrazol has been proven to shield a number of crops against environmental stressors such as heat radiation, drought, and cold. By inhibiting the synthesis of ent-kaurene in the metabolic pathway involved in gibberellin manufacturing, paclobutrazol prevents the creation of gibberellins, which reduces the quantity of active gibberellins produced and, as a consequence, reducing internodal growth and inhibits the stem elongation (Mansuroglu *et al*., 2009; Ahmad *et al*., 2014; Tesfahun, 2018 and Arya and Fatmi, 2022).

Many researchers sprayed different plants with various concentrations of paclobutrazol and maleic hydrazide, and demonstrated that the inhibitors reduced stem length and flower stalk length, but they increased number of branches, flower diameter, number and fresh and dry weights such as (Kumar *et al*., 2014; Bashiri and Jowkar, 2017; Sikarwar and Vikram, 2017; Wasiq *et al*., 2020 and Punitha *et al*., 2023).

Therefore, the target of this investigation was to examine effect of paclobutrazol and maleic hydrazide on *Tagetes patula* L. flowering.

## 2. MATERIALS AND METHODS

In order to investigate the impact of paclobutrazol and maleic hydrazide on *Tagetes patula* L. flowering, a pot experiment was conducted at The Nursery of Floriculture, Fac. Agric., Minia Univ., during the two consecutive seasons of 2022 and 2023. The experiment was laid out in a complete randomized design (CRD) with three replications. Each treatment contained 3 pots (3 plants/treatment), so the total number of plants per replicate was 21 plants (7 treatments x 3 plants), consequent the experiment contained 63 plants (21 plant x 3 replicates) in each season.

The seedlings of French marigold (uniform in size and had four leaves) were provided by the Nursery of Floriculture Plants, Fac. Agric., Minia Univ. and had been transplanted on March 20$^{th}$, 2022 and 2023, in pots that were 25 cm in diameter and filled with 13.5 kg of media [contain sand + compost (1:3, v/v)], with one transplant per pot. As shown in Tables (a and b), the physio-chemical properties of used soil (sand and compost), were carried out as outlined by ICARD (2013).

**Table a. The physio-chemical analysis of the used sandy soil.**

| Soil character | Values | | Soil Character | Values | |
|---|---|---|---|---|---|
| | 2022 | 2023 | | 2022 | 2023 |
| **Physical properties** | | | **Soluble nutrients** | | |
| **Sand (%)** | 90.22 | 91.30 | **$Ca^{++}$ (ppm)** | 129.2 | 133.3 |
| **Silt (%)** | 4.41 | 4.72 | **$Mg^{++}$ (ppm)** | 56.2 | 62.4 |
| **Clay (%)** | 5.37 | 3.98 | **$Na^{+}$ (ppm)** | 72.5 | 71.3 |
| **Soil type** | Sandy | Sandy | **$K^{+}$ (ppm)** | 10.7 | 13.6 |
| **Chemical properties** | | | **DTPA-Extractable nutrients** | | |
| **pH (1:2.5)** | 8.09 | 8.12 | **Fe (ppm)** | 0.72 | 0.77 |
| **E.C. (dS/m)** | 1.20 | 1.24 | **Cu (ppm)** | 0.34 | 0.37 |
| **O.M. (%)** | 0.11 | 0.12 | **Zn (ppm)** | 0.30 | 0.32 |
| **$CaCO_3$ (%)** | 11.11 | 11.50 | **Mn (ppm)** | 0.40 | 0.48 |

Both retardant treatments (control, Maleic Hydrazide. MH, at 700, 1000 and 1300 ppm, and Paclobutrazol, PBZ, at 100, 200 and 400 ppm) were sprayed three times, to full wetness, starting on April 5$^{th}$ and continuing through May 5$^{th}$, all growth regulator treatments at intervals of two weeks, using a hand sprayer. Tab water was used to apply the control treatment during both growth seasons.

**Table b. The physio-chemical analysis of the used compost.**

| Properties | Value | Properties | Value |
|---|---|---|---|
| **Organic carbon (%)** | 25.22 | **Total P (%)** | 0.57 |
| **Humidity (%)** | 23.18 | **Total K (%)** | 1.11 |
| **Organic matter** | 43.38 | **Fe (ppm)** | 523 |
| **C/N ratio** | 15.66 | **Zn (ppm)** | 60 |
| **pH (1:2.5)** | 8.14 | **Mn (ppm)** | 116 |
| **E.C. (m. mhos/cm.)** | 5.15 | **Cu (ppm)** | 185 |
| **Total N (%)** | 1.61 | | |

The flowers were weekly hand-picked (five weeks) across both seasons, from October 10th to November 13th (1st pick from 10 to 16, 2nd pick from 17 to 23, 3rd pick from 24 to 30, 4th pick from 31 October to 6 November and 5th pick from 7 to 13 November). At the beginning of flowering stage, the growth traits (plant height and number of branches) were documented. The following flower aspects were noted: flower diameter (cm), stalk length (cm), number/plant, and fresh and dry weights per plant (g), per cut and per season.

Analysis of variance (ANOVA) was performed on the data for each parameter included in this research using the computer program software MSTAT–C (1986). Using the Least Significant Difference, the treatment means were assessed at the 5% probability level.

## 3. RESULTS

### 3.1. Vegetation development

Data presented in Table (1) showed that the effect of growth retardants was varied, where, all used treatments significantly decreased plant height but they significantly increased number of branches/plant in both seasons facing the control. The effect of the two growth retardants (maleic hydrazide and paclobutrazol) were increased with the increase of concentrations. So, paclobutrazol at 400 ppm and maleic hydrazide at 1300 ppm were more effective in plant height as gave 49.32 and 57.68 cm in the first season and 52.20 and 60.96 cm in the second season, respectively, and number of branches/plant as recorded 12.04 and 10.80 branches in the first season 12.14 and 11.16 branches in the second season, respectively, without significant differences were detected between them.

Similar results were obtained by Niu *et al*. (2002) on Poinsettia Freedom; Mansuroglu *et al*. (2009) on *Consolida orientalis*; Ahmad *et al*. (2015) on some ornamental plants; Bashiri and Jowkar (2017) on Cineraria and Fatmi and Arya (2022) on African Marigold, regarding the effect of paclobutrazol. And Majeed *et al*. (2017), Sathappan (2018) and Arya and Fatmi (2022) on African Marigold and Punitha *et al*. (2023) on Golden rod (*Solidago canadensis*), concerning the effect of maleic hydrazide.

**Table 1. Effect of maleic hydrazide and paclobutrazol on plant height and mean of branches number/plant of *Tagetes patula* during both seasons (2022 and 2023).**

| Growth retardants treatments (ppm) | Plant height (cm) | | Branches number/plant | |
|---|---|---|---|---|
| | First season | Second season | First season | Second season |
| **Control (Without)** | 69.60 | 73.68 | 8.64 | 8.76 |
| **MH at 700 ppm** | 60.72 | 64.56 | 9.94 | 10.02 |
| **MH at 1000 ppm** | 59.16 | 62.64 | 10.08 | 10.38 |
| **MH at 1300 ppm** | 57.48 | 60.96 | 10.80 | 11.16 |
| **PBZ at 100 ppm** | 61.62 | 63.82 | 11.04 | 11.40 |
| **PBZ at 200 ppm** | 53.64 | 56.88 | 11.64 | 12.02 |
| **PBZ at 400 ppm** | 49.32 | 52.20 | 12.04 | 12.14 |
| **L.S.D. at 5 %** | 7.88 | 9.76 | 1.25 | 1.09 |

Where: MH: Maleic Hydrazide and PBZ: Paclobutrazol.

### 3.2. Flowering characteristics

The effect of growth retardants on French marigold flower traits was presented in Tables (2 and 3). It is obvious that flowering production i.e., flower diameter, flower stalk length, flower number per plant and flower fresh and dry weights per every cut were significantly enhanced due to both retardants, except the flower stalk length throughout the five picks during both experimental seasons relative to untreated plants. Regardless the treatments, the best values were recorded with the fourth pick.

Regardless the number of cuts, data in Table (4) showed that both growth retardants, each at three concentrations, significantly increased mean flower diameter, total flower yield/plant, total flower fresh and dry weights/ plant relative to the control and significantly reduced mean flower stalk length in both seasons. It is noticed that the enhancement and reduced effect of both retardants were increased or decreased with increasing the concentration of paclobutrazol and maleic hydrazide. So, the largest mean flower diameter 3.52 and 3.43 cm, highest flower yield/plant (60.67 and 55.45), heaviest flower fresh weight/plant (102.70 and 89.51 g) and heaviest flower dry weight/plant (39.72 and 32.88 g) and the shortest mean flower stalk (8.66 and 9.31 cm) in the first season were recorded due to paclobutrazol (400 ppm) and maleic hydrazide (1300 ppm), respectively facing the control (3.06 cm, 29.14 flowers, 53.11 g FW, 16.83 g DW and 10.87 cm), respectively. The same trend was obtained in the second season.

Similarly, Mansuroglu *et al*., 2009; Ahmad *et al*., 2014; Tesfahun, 2018 and Arya and Fatmi, 2022 for paclobutrazol and Kasem and Abd El-Baset, 2015; Malik *et al*. 2017; Karki *et al*., 2021 and Pal *et al*., 2021 regarding maleic hydrazide.

## 4. DISCUSSION

Because of the growth retardant's restrictive effect, the cells became smaller, which increased the quantity of chlorophyll within the reduced cell capacity (Thakur, 2022). In order to create dense plants and alter the blooming time to produce more blooms, numerous plant growth retardants were used (Kumar *et al*. 2011).

Paclobutrazol (PBZ) prevents kaurene from oxidizing to kaurenoic acid and plays a part in controlling the formation of gibberellin. In particular, it inhibits the microsomal oxidation of kaurene, Kuarenal, and kaurenol and reacts with acytochrome P-450 and kaurene oxidases (Arya and Fatmi, 2022).

Maleic hydrazide is a synthetic growth retardant that operates in a number of ways on the plant's natural development process, which is most likely the main cause of the plant's height decline. They function in a sub-apical system, reducing plant height and either inhibiting or decreasing cell division. Therefore, the plant becomes dwarfed since the internodes are unable to extend (Wasiq *et al*., 2020).

## 5. CONCLUSION

The results of this study point to the potential benefits of using maleic hydrazide and paclobutrazol to manage French marigold growth and flowering. Plant height and flower stalk length were negatively impacted by the usage of both growth retardants, which also increased the quantity of branches and flower traits. In general, elevated concentrations of maleic hydrazide and paclobutrazol exhibited the intended outcomes in adjusting the characteristics of vegetative and flower quality and quantity of *Tagetes patula*, therefore augmenting dwarfing and the plant's economic worth within the potted flower sector.

When growth retardants are applied to French marigold, they cause dwarfism and enhance the quality of the flowers. This modifies the plant architecture under the maleic hydrazide and paclobutrazol.

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**Table 2. Effect of maleic hydrazide and paclobutrazol on flower diameter, flower stalk length and flower yield of *Tagetes patula* in the five picks during both seasons (2022 and 2023).**

| Growth retardants treatments (ppm) | Pick number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | First | Second | Third | Fourth | Fifth | First | Second | Third | Fourth | Fifth |
| | The first growing season (2022) | | | | | The second growing season (2023) | | | | |
| **Flower diameter (cm)** | | | | | | | | | | |
| **Control (Without)** | 2.47 | 2.86 | 3.31 | 3.38 | 3.29 | 2.60 | 2.87 | 3.52 | 3.44 | 3.34 |
| **MH at 700 ppm** | 2.57 | 2.94 | 3.43 | 3.49 | 3.41 | 2.69 | 3.01 | 3.66 | 3.55 | 3.47 |
| **MH at 1000 ppm** | 2.62 | 3.04 | 3.52 | 3.55 | 3.50 | 2.72 | 3.12 | 3.72 | 3.61 | 3.54 |
| **MH at 1300 ppm** | 2.66 | 3.24 | 3.76 | 3.79 | 3.72 | 2.80 | 3.31 | 3.82 | 3.83 | 3.71 |
| **PBZ at 100 ppm** | 2.64 | 3.16 | 3.68 | 3.74 | 3.70 | 2.78 | 3.18 | 3.83 | 3.80 | 3.72 |
| **PBZ at 200 ppm** | 2.68 | 3.20 | 3.77 | 3.82 | 3.73 | 2.81 | 3.24 | 3.88 | 3.83 | 3.76 |
| **PBZ at 400 ppm** | 2.74 | 3.31 | 3.86 | 3.88 | 3.79 | 2.87 | 3.44 | 3.95 | 3.92 | 3.80 |
| **L.S.D. at 5 %** | 0.09 | 0.08 | 0.12 | 0.10 | 0.08 | 0.08 | 0.14 | 0.13 | 0.11 | 0.10 |
| **Flower stalk length (cm)** | | | | | | | | | | |
| **Control (Without)** | 12.72 | 10.90 | 10.97 | 10.22 | 9.56 | 14.99 | 12.28 | 12.26 | 10.67 | 9.76 |
| **MH at 700 ppm** | 11.48 | 10.02 | 10.08 | 9.56 | 8.63 | 13.48 | 11.62 | 11.12 | 10.09 | 9.04 |
| **MH at 1000 ppm** | 11.32 | 10.00 | 9.98 | 9.50 | 8.68 | 13.28 | 11.48 | 10.98 | 9.97 | 9.24 |
| **MH at 1300 ppm** | 10.67 | 9.91 | 9.19 | 8.82 | 7.98 | 12.94 | 11.27 | 10.24 | 9.01 | 8.15 |
| **PBZ at 100 ppm** | 11.38 | 9.90 | 9.61 | 9.38 | 8.02 | 12.64 | 11.42 | 10.76 | 9.72 | 9.10 |
| **PBZ at 200 ppm** | 11.04 | 9.23 | 9.19 | 8.48 | 7.51 | 12.10 | 11.09 | 10.09 | 8.88 | 8.40 |
| **PBZ at 400 ppm** | 10.18 | 9.05 | 8.71 | 8.21 | 7.13 | 11.44 | 10.66 | 9.12 | 8.51 | 8.09 |
| **L.S.D. at 5 %** | 0.52 | 0.87 | 0.51 | 0.62 | 0.86 | 1.51 | 0.62 | 1.14 | 0.51 | 0.07 |
| **Flower yield/plant** | | | | | | | | | | |
| **Control (Without)** | 4.67 | 5.41 | 5.90 | 6.85 | 6.31 | 5.47 | 5.96 | 6.61 | 8.05 | 7.14 |
| **MH at 700 ppm** | 6.05 | 6.77 | 7.20 | 7.99 | 7.22 | 6.88 | 7.60 | 7.79 | 9.10 | 7.90 |
| **MH at 1000 ppm** | 7.28 | 7.86 | 8.22 | 9.00 | 8.26 | 7.92 | 8.30 | 8.89 | 9.61 | 8.88 |
| **MH at 1300 ppm** | 10.06 | 10.77 | 11.50 | 12.54 | 10.58 | 11.45 | 11.15 | 12.27 | 13.69 | 11.64 |
| **PBZ at 100 ppm** | 8.56 | 8.94 | 10.03 | 11.04 | 9.98 | 9.66 | 9.71 | 11.06 | 11.90 | 11.04 |
| **PBZ at 200 ppm** | 9.97 | 10.46 | 11.17 | 12.07 | 10.31 | 10.87 | 10.99 | 11.99 | 12.77 | 11.84 |
| **PBZ at 400 ppm** | 11.16 | 11.96 | 12.77 | 13.63 | 11.15 | 12.83 | 12.77 | 13.39 | 14.71 | 12.38 |
| **L.S.D. at 5 %** | 1.12 | 1.22 | 1.29 | 1.10 | 0.68 | 1.39 | 1.63 | 1.15 | 1.04 | 0.75 |

Where: MH: Maleic Hydrazide and PBZ: Paclobutrazol.

**Table 3. Effect of maleic hydrazide and paclobutrazol on flower fresh and dry weights/plant (g) of *Tagetes patula* in the five picks during both seasons (2022 and 2023).**

| Growth retardants treatments (ppm) | Pick number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | First | Second | Third | Fourth | Fifth | First | Second | Third | Fourth | Fifth |
| | The first growing season (2022) | | | | | The second growing season (2023) | | | | |
| | Flower fresh weight/plant (g) | | | | | | | | | |
| **Control (Without)** | 7.27 | 9.04 | 11.13 | 13.67 | 12.00 | 8.83 | 10.69 | 12.14 | 13.11 | 14.03 |
| **MH at 700 ppm** | 9.58 | 11.90 | 14.47 | 16.23 | 14.98 | 11.86 | 14.97 | 18.75 | 19.84 | 17.84 |
| **MH at 1000 ppm** | 10.85 | 13.14 | 16.55 | 17.34 | 16.37 | 12.29 | 16.68 | 19.28 | 21.35 | 20.30 |
| **MH at 1300 ppm** | 13.64 | 17.70 | 18.68 | 20.51 | 18.98 | 15.25 | 20.52 | 25.26 | 26.42 | 25.02 |
| **PBZ at 100 ppm** | 10.88 | 13.58 | 16.64 | 18.23 | 16.93 | 12.53 | 13.46 | 21.25 | 22.30 | 21.59 |
| **PBZ at 200 ppm** | 12.25 | 14.87 | 18.11 | 19.64 | 18.76 | 14.18 | 17.28 | 22.48 | 24.84 | 23.62 |
| **PBZ at 400 ppm** | 15.74 | 20.55 | 21.60 | 22.92 | 21.26 | 18.00 | 25.76 | 31.18 | 32.64 | 28.63 |
| **L.S.D. at 5 %** | 2.12 | 2.86 | 2.94 | 2.44 | 2.31 | 2.77 | 4.25 | 5.93 | 6.25 | 3.65 |
| | Flower dry weight/plant (g) | | | | | | | | | |
| **Control (Without)** | 2.66 | 3.05 | 3.28 | 4.16 | 3.68 | 2.85 | 3.31 | 3.73 | 4.21 | 3.91 |
| **MH at 700 ppm** | 3.78 | 4.55 | 4.98 | 5.77 | 5.29 | 4.05 | 4.96 | 5.62 | 5.93 | 5.51 |
| **MH at 1000 ppm** | 4.16 | 5.00 | 5.71 | 6.48 | 6.02 | 4.79 | 5.52 | 6.17 | 6.65 | 6.23 |
| **MH at 1300 ppm** | 5.24 | 6.28 | 6.74 | 7.54 | 7.08 | 5.75 | 7.01 | 7.33 | 7.78 | 7.81 |
| **PBZ at 100 ppm** | 4.19 | 5.03 | 6.17 | 7.40 | 7.00 | 4.79 | 5.71 | 6.62 | 7.67 | 7.22 |
| **PBZ at 200 ppm** | 4.72 | 5.51 | 6.38 | 7.97 | 7.69 | 5.40 | 6.20 | 7.32 | 8.28 | 7.30 |
| **PBZ at 400 ppm** | 6.32 | 7.66 | 8.26 | 9.12 | 8.36 | 6.90 | 8.62 | 8.98 | 9.38 | 8.94 |
| **L.S.D. at 5 %** | 1.10 | 1.39 | 1.53 | 1.60 | 1.30 | 1.17 | 1.62 | 1.67 | 1.63 | 1.15 |

Where: MH: Maleic Hydrazide and PBZ: Paclobutrazol.

**Table 4. Effect of maleic hydrazide and paclobutrazol on flowering characters of *Tagetes patula* during the five picks in both seasons (2022 and 2023).**

| Growth retardants treatments (ppm) | Flowering characters | | | | |
|---|---|---|---|---|---|
| | Mean flower diameter (cm) | Mean flower stalk length (cm) | Total flower yield | Total flower fresh weight (g/plant) | Total flower dry weight (g/plant) |
| **The first growing season (2022)** | | | | | |
| **Control (Without)** | 3.06 | 10.87 | 29.14 | 53.11 | 16.83 |
| **MH at 700 ppm** | 3.17 | 9.95 | 35.23 | 67.16 | 24.37 |
| **MH at 1000 ppm** | 3.25 | 9.90 | 40.62 | 74.25 | 27.37 |
| **MH at 1300 ppm** | 3.43 | 9.31 | 55.45 | 89.51 | 32.88 |
| **PBZ at 100 ppm** | 3.38 | 9.66 | 48.55 | 76.26 | 29.79 |
| **PBZ at 200 ppm** | 3.44 | 9.09 | 53.98 | 83.63 | 32.27 |
| **PBZ at 400 ppm** | 3.52 | 8.66 | 60.67 | 102.07 | 39.72 |
| **L.S.D. at 5 %** | 0.10 | 0.68 | 5.25 | 12.61 | 6.93 |
| **The second growing season (2023)** | | | | | |
| **Control (Without)** | 3.15 | 11.99 | 33.23 | 58.80 | 18.01 |
| **MH at 700 ppm** | 3.28 | 11.07 | 39.27 | 83.26 | 26.07 |
| **MH at 1000 ppm** | 3.34 | 10.99 | 43.60 | 89.90 | 29.36 |
| **MH at 1300 ppm** | 3.49 | 10.32 | 60.20 | 112.47 | 35.68 |
| **PBZ at 100 ppm** | 3.46 | 10.73 | 53.37 | 91.13 | 32.01 |
| **PBZ at 200 ppm** | 3.50 | 10.11 | 58.46 | 102.40 | 34.50 |
| **PBZ at 400 ppm** | 3.60 | 9.56 | 66.08 | 136.21 | 42.82 |
| **L.S.D. at 5 %** | 0.12 | 0.79 | 5.91 | 23.77 | 7.17 |

Where: MH: Maleic Hydrazide and PBZ: Paclobutrazol.

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## الملخص العربي

## إنتاجية الأزهار للقطيفة الفرنسية متأثرة بالماليك هيدرازيد والباكلوبترازول

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تم إجراء هذا البحث خلال موسمي نمو متتاليين لعامي ٢٠٢٢ و ٢٠٢٣ في مشتل الزينة قسم البساتين – كلية الزراعة – جامعة المنيا لدراسة تأثير الباكلوبترازول ومماليك هيدرازيد على النمو الخضري (ارتفاع النبات وعدد الأفرع)، وإنتاجية الأزهار لكل قطفة وخلال موسم النمو (قُطر الزهرة، طول الشمراخ الزهري، محصول الأزهار، الأوزان الطازجة والجافة للأزهار) لنبات القطيفة الفرنسية. أدى رش النباتات بجميع تركيزات المثبطات (ماليك هيدرازيد والباكلوبترازول) إلى انخفاض معنوي في ارتفاع النبات وزيادة معنوية في عدد الأفرع لنباتات القطيفة الفرنسية. وفي نفس الوقت، زادت جميع الصفات الزهرية المدروسة بزيادة تركيز ماليك هيدرازيد والباكلوبترازول، باستثناء طول الساق الذي انخفض معنوياً في كلا الموسمين مقارنة بالكنترول. وفي معظم الحالات، كانت القطفة الرابعة هي الأفضل في هذا الصدد.

**الكلمات المفتاحية:** القطيفة الفرنسية، صفات النمو، إنتاجية الأزهار، ماليك هيدرازيد، باكلوبترازول.