Production of Dianthus Caryophyllum L. Cultivar (Nanus) as A potted Flowering Plant Using Two Growth Retardants (Alar and Paclobutrazol)

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Abstract

The experiment of one factor was carried out in the greenhouse of the University of Kirkuk - College of Agriculture - Agricultural Research and Experiment Station for the two agricultural seasons 2020-2021, by planting the seeds of the Carnations (Nanus) plant in special dishes for planting seeds filled with peat moss on 1-10-2020, when the reaching the required size of the root system, the seedlings were transferred on 20-1-2021 to the final and required size of the pots with a diameter of (13 cm) and were treated with two types of plant growth retardants (Alar and Paclobutrazol) at two different levels in addition to the control treatment (100-200) mg.l⁻¹ Alar, (100-200) mg.l⁻¹ Paclobutrazol and the spraying process was repeated 15 days after the first spray. The experiment resulted in a significant superiority of Paclobutrazol at the concentration 200 mg.l⁻¹, as it was significantly superior by giving the lowest plant height and the highest flowers diameter compared to Alar factor and the control treatment, while Alar was significantly superior at the concentration of 100 mg.l⁻¹ by giving the largest number of plant branches and the largest number of flowers compared to Paclobutrazol and control.

Keywords : Dianthus caryophyllum L., Alar and Paclobutrazol.

1. Introduction

*Dianthus caryophyllum* L. is related to Caryophyllaceae family whose plants grow in the temperate regions of the northern hemisphere. This family includes 2100 species and 89 genera. The genus Dianthus contains nearly 300 species that grow in Asia, Europe and North Africa [1]. Carnations need special agricultural operations such as disbudding, fertilization, pinching and consolidation, and their roots are very sensitive to heavy soils and poor drainage, which affects the growth and production of the plant [2]. The volatile oil of carnation flowers is used for medicinal purposes, as it is considered a strong diaphoretic and works to strengthen the heart, in addition to its industrial uses in baby food, sweets and perfumes [3,4]. The boiled flower tops is also considered as a gas repellent, a mouth freshener, an analgesic for pain, especially the teeth, an antiemetic, an anti-colic, a memory booster and an appetizer [5]. Carnations is affected by diseases, humidity, and heavy rain, and one of the requirements that must be done to obtain high commercial quality flowers is using protected environment because the flowers that grow in open fields dose not comply with international flower production standards [6]. Carnations is a responding quantitative long-day plant, and six-leaf pairs are sufficient to receive the floral response [7].

Alar (2,2-dimethyl hydrazide) is one of the plant growth retardants, Which is a fast-moving compound in the plant and spreads quickly from the point of addition to the rest of the plant, it may exist in free form or in the form of ionized acid and causes obstruction of growth and early flowering of some plants [8]. [9] proved when conducting research on the geranium plant *Pelargonium horotorum* when using different levels of alar (0, 1000, 2000) mg.l⁻¹, as treatment at the level 1000 mg.l⁻¹ led to an increase in the diameter of the flower stem and a decrease in the length the flower stem and the height of the plant compared to the comparison plants. In a research conducted by [10] on *Narcissus* spp. Salome cultivar using different levels of the growth retardant (0, 500, 1000) mg.l⁻¹, and the study proved that spraying with larch at a concentration of 1000 mg.l⁻¹ caused a significant increase in the diameter of the flower stem and the age of the flower on the plant and a significant decrease in the Plant height and flower stem length.

Paclobutrazol is a growth retardant, which is sold commercially under many names, such as Bonzi and is used for ornamental plants, Parsley is used for weeds of green areas, Clipper for trees in general, and Culter for fruit trees, a member of the Triazole group, which was discovered in 1976, and proved to be effective for a wide range of uses, plant species, including many herbaceous and woody plants, have been shown to be insensitive to other growth retardants [11]. It was shown by [12] when the lily plant (*Polianthes tuberosa* L.) was treated with Paclobutrazol at concentrations (0, 500, 1000, 1500) mg.l⁻¹ by spraying it on the shoots of the plant that the increased levels of Paclobutrazol led to a significant reduction in the height of...
the plant. Plants that were sprayed with Paclobutrazol at a concentration of 1500 mg.L⁻¹, had lowest number of leaves and decreased with an increase in the concentration used to 1500 mg.L⁻¹, as well as the lowest length of the flower stem and had an increase in the diameter of the flowers, while the leaf area increased when spraying with a concentration of 500 mg.L⁻¹. The number of florets also increased compared to the comparison plants with which treatment. In a study conducted by [13] when soaking two cultivars of narcissus (Tahiti and Salome) in 50 mg.L⁻¹ of Paclobutrazol, the soaking reduced the height of the plant, the time required for the appearance of color in the first flower, and reduced the length of the flower stem compared to with untreated plants. In view of the lack of studies on the production of carnations as pot plants and with high commercial specifications at the level of the greenhouse, the experiment aimed to the possibility of producing carnations of the (Nanus) variety as a flowering pot plant with a thick stem diameter through the use of high concentrations of plant growth retardants, thus eliminating the problem of breaking or lying down of the plant stem during transportation and marketing due to the low thickness of most carnations.

2. Materials and Methods

The experiment of one factor was carried out in the greenhouse of the University of Kirkuk - College of Agriculture - Agricultural Research and Experiment Station for the two agricultural seasons 2020-2021, by planting the seeds of the Carnations (Nanus) plant in special dishes for planting seeds filled with peat moss on 1-10-2020, and after the seeds germination and to reach the appropriate size, it was transferred on 12-15-2020 to pots with a diameter of (6 cm) to obtain a larger root total, and when the required size of the root system was reached, the seedlings were transferred on 20-1-2021 to the final and required size of pots with a diameter of (13 cm), which were filled in advance with a mixture of peat moss and river mixture in a ratio of 1:2, and the process of pinching the plants was done when they reached eight pairs of leaves. On 1-3-2021, the plants were treated with two types of plant growth retardants (Alar and Paclobutrazol) at two different levels, in addition to the control treatment (0, 100-200 Alar, 100-200 Paclobutrazol) mg.L⁻¹, and the spraying process was repeated after 15 days of the first spraying, and all the different agricultural operations such as irrigation and weeding were carried out whenever needed, and the fertilization was carried out monthly with compound fertilizer (NPK 20:20:20) with irrigation water at a rate of 0.5 g.L⁻¹ until the end of the experiment. The insecticide (CONFIDOR) and the fungicide (PREVICUR) were used at a concentration of 50 ml.100 liters⁻¹ water for the purpose of protecting plants from insect and fungal infections by spraying them on plants periodically by three sprays and a month apart from one spray to another. The experiment was designed according to a randomized complete block design (RCBD). The Statistical analysis was done computer using by the SAS program [14]. The results were tested according to Duncan's multiple range test at a probability level of 5% according to [15]. The following characteristics were studied: plant height (cm), number of branches.plant⁻¹, diameter of the first flower (cm), number of flowers.plant⁻¹.

3. Results and Discussion

3.1 Plant height (cm)

It was shown from Figure No. (1) that there were significant differences in the plant height characteristic when treated with plant growth retardants, as it was superior to the treatment of Paclobutrazol and gave the lowest plant height reached (9 cm) when treated with concentration 200 mg.L⁻¹; followed by concentration 100 mg.L⁻¹, which it reached (9.86 cm), while treatment with Alar gave the highest plant height at concentrations (200 and 100) mg.L⁻¹, which reached (13.44 and 13.94) cm, respectively. This result may be explained according to the physiological effect of Paclobutrazol, which was mentioned by [16] that it is possible to impede the growth through the inhibition of oxidation reactions in the stages of building gibberellins, especially the inhibition of the oxidation processes that occur in the microsome of Kaurene, Kaurenol and Kaurenal, which is one of the aspects of the action of a number of other growth retardants of different composition, such as animidol, as well as Paclobutrazol. It has been observed that the content of gibberellin-like substances in plants treated with Paclobutrazol is lower than the untreated ones, thus the cell division processes continue, but the new cells will not elongate [17], and this is consistent with what [13] found.

3.2 Number of branches. plant⁻¹

It was observed from Figure No. (2) for the characteristic of the number of branches.Plant⁻¹ was superior to the comparison treatment, which gave the highest number of branches reached (15.33) branches.Plant⁻¹ compared to the treatment of Paclobutrazol at the concentration of 200 mg.L⁻¹, which gave the lowest number of branches (8.5) plant⁻¹, while Alar had a greater effect on increasing the number of branches, which amounted to (14.33) branch.plant⁻¹ at the concentration of 100 mg.L⁻¹ compared to the concentration of 200 mg.L⁻¹ and the rest of the concentrations of Paclobutrazol. This result may explain
the high concentration of Paclobutrazol reduced the height of the plant, which in turn led to a reduction in the photosynthesis process and thus led to a reduction in the number of branches formed on the plant, and this is consistent with what [18] found.

![Figure 1. Effect of Alar and Paclobutrazol on plant height (cm).](image1)

**3.3 Diameter of the first flower (cm)**

Figure No. (3) shows that there are significant differences in the characteristic of flower diameter (cm), as the growth retardant outperformed Paclobutrazol at the concentration of 200 mg.L\(^{-1}\) by giving it the highest flower diameter of (4.8 cm) compared to the concentration of 100 mg.L\(^{-1}\) for the same retardant, and (200 and 100) mg.L\(^{-1}\) for Alar factor and the comparison treatment, which were (4.72, 4.26, and 4.13) cm, respectively. The reason may be that Paclobutrazol increases the transverse expansion of the cell and increases its division [19] and this is consistent with the findings of [20].

![Figure 2. Effect of Alar and Paclobutrazol on the number of branches.plant\(^{-1}\).](image2)

**3.4 Number of flowers.plant\(^{-1}\)**

As for Figure No. (4), it was noted that the comparison treatment was significantly superior by giving it the highest number of flowers that reached (81.66) flower.plant\(^{-1}\) compared with all concentrations of Alar and Paclobutrazol, and the reason for this may be due to the fact that Paclobutrazol reduced the height and size of the plant and thus reduced the number of plants the branches formed on the plant, which in turn lead to a reduction in the number of flowers formed on the plant, and this is consistent with the findings of [18].
Figure 3. Effect of Alar and Paclobutrazol on flower diameter (cm).

Figure 4. Effect of Alar and Paclobutrazol on the number of flowers/plant -1.

Conclusions

We conclude from the experiment that Paclobutrazol at the concentration 200 mg.l-1 was significantly superior by giving the lowest plant height and the highest diameter in flowers compared to Alar factor and the control treatment, while Alar was significantly superior at the concentration 100 mg.l-1 by giving it the largest number of plant branches and the largest number of flowers compared to Paclobutrazol and control.

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