Response Polianthes Tuberosa L.to Cold Storage Time and Chitosan on Vegetative Growth and Floral

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Abstract. The study was conducted at the Horticultural Establishments Unit of the Department of Horticulture and Landscape - College of Agriculture - Tikrit University. for period from 15/3/2020 to 15/1/2021, aim of knowing response of polyanthus bulbs to cold storage before planting and spraying with Chitosan. two factors: first was storage of bulbs before planting at a degree of 5 C° for a period of 0, 1, 2 a week, and the second factor was sprayed with chitosan at a concentration of 0, 500, 1000 mg. L⁻¹ the experiment was designing with RCBD in three replications. The results showed that the two-week storage treatment exceeded the number of leaves, Leaves area, and leaf width gave 19.37 leaves. Plant⁻¹, 703.84 cm², 17.65 mm, respectively. The treatment of spraying with chitosan at a concentration of 1000 mg. L⁻¹ was superior to infloresences length and the diameter of the roses, and it gave 88.71 cm, 34.70 mm. The highest concentration (nitrogen, phosphorus and potassium) was 1.99, 0.368, 2.21% for the interaction between storage for two weeks and spraying with chitosan at a concentration of 1000 mg. L⁻¹.

1. Introduction
Polianthes tuberosa L. is one of the most important flowering and perennial bulbs that are common worldwide as picking flowers. He is a monocotyledon [1] It belongs to the genus Polianthes and belongs to the family (Amaryllidaceae). Mexico is considered his home [2]. Tuberose is one of the ten main ornamental plants, and the plant has an elegant and selective place among all ornamental plants because of its elegant shape, attractive flowers with a fragrant aromatic scent, attractive plant shape and its use as picking flowers, mainly for the length of its stems and its long flowers of elegant white and waxy color and long flowering life of the plant as it is used in extracting oils Aromatic many uses, including perfumery and the preparation of cosmetics [3]. bulbs need to be left in the ground for the following year in order to bloom well and better, but they can be uprooted and stored under certain conditions and for a certain period after the leaves dry out and the bulbs form. The bulbs go through a dormant period and start from the period of leaves falling or yellowing until the bulbs are able to prepare for growth, which is called the dormancy phase of the bulbs. The storage forcing bulbs for early flowers to produce flowers with good specifications for export and for local consumption at a specific time, as it is not a requirement to obtain excellent flowers, but rather to encourage the plant to switch from the stage of vegetative growth to flowering growth, and the temperatures promote the start of flowering and increase its quality and yield for the bulbs [4] [5]. The timing of the appearance of the first flowers is directly influenced by the average temperature and the growth temperature is (21-22)
C°, which gives a growth rate at its maximum [6], and the temperature change greatly affects its growth and flowering [7,8]. indicated through the experiment that they conducted to demonstrate the effect of temperature on the differentiation and quality of the tuberose flower. The bulbs were stored at four temperatures (0, 4, 12, 27) C° and for the duration of its storage is (4, 5, 6, 7) weeks and for two seasons, the 7-week storage reduced the number of flowers, while the 5-week storage treatment gave an increase in the diameter of height spiky and the height, and the 6-week storage treatment exceeded diameter flower stalk.

Chitosan is a natural biopolymer (one of the bio stimulants) and it is one of the alternatives to traditional fertilizers and has been used in many physiological studies to determine its effect on the growth of plants. It is determined according to three criteria: the morphological composition, the degree of tissue removal, and the molecular weight [9]. The ability to stimulate a plant reaction through its effect on microorganisms. One of the factors that most affect the biological activity of this biopolymer is the molecular weight [10]. [11] mentioned that Polianthes tuberosa L. was sprayed (singular) to spray with different concentrations of chitosan CHT 60 ppm for two seasons, where the plants were sprayed two months after planting at a rate of 6 sprays between one spray and another for 15 days, and the results showed superiority. The concentration is 60 CHT and for the two seasons in the growth characteristics, plant height, number of leaves, leaf width, number of flowers, length of flowering fennel flower, leaf content of nitrogen, potassium phosphorus, total chlorophyll and carotenoids in leaves. In view studies on Polyanthus plant in Iraq, this study aimed to find out the effect of storage the bulbs and spraying with chitosan under the environmental conditions of Salah al-Din Governorate.

2. Materials and Methods
The experiment was conducted in the Horticultural Unit of the Department of Horticulture and Landscape - College of Agriculture - Tikrit University. Iraq for period from 15/3/2020 to 15/1/2021. Plant material:
Polianthes tuberosa L. variety (Double) with white flowers from Syria. bulbs were cleaned, and 1.6 - 2 cm in diameter. Pots 19 cm were used, bulbs were planted at a depth of 5-8 cm on 15/3/2020 in mixture soil: peat moss: perlite (2: 1: 2) and by six pots in one experimental unit, the plants were fertilized with NPK (1) g. L-1.

2.1 Experment design:
The experiment was designed with Randomized Complete Block Design (R.C.B.D) included two factors: Cold storage of bulbs at a temperature of 5 C° with three levels (1 and 2) week in addition to without storage. Spraying with chitosan in three concentrations (0, 500, 1000) mg. L-1. Dissolve chitosan with acetic acid vinegar and add 5 ml to the spraying four times, the first after 2 months of planting, and the second and third after 15 days, while the fourth took place when flowering. Characteristics of vegetative growth: number of leaves. leaf width (mm). Leaves area (cm2). percentage of nitrogen, phosphorous and potassium was determined in dry leaves [12]. total chlorophyll and carotenoids content in the leaves [13]. Characteristics flowering growth: pedicle length (cm). diameter of stalk flower(mm). Number of florets ,Flower diameter (mm). Statistical data analysis: The data were analyzed statistically using [14]. The differences between the coefficients were compared according to the Duncan's Multiple Range Test (DMRT) at a probability level of 5%.

3. Results and Discussion
The results presented in Table (1) indicate the superiority of the 2-weeks cold storage treatment in most of the traits, the number of leaves, leaf width, leaf area, the amount of carotenoids in the leaves, nitrogen, phosphorus and potassium, and it reached 19.73 leaf-1, 17.85 mm 703.84 cm 2, 2.21 g / 100 wet weight 1.83%, 0.357%, 2.14%, while there were no significant differences in the chlorophyll content of leaves. As for spraying with Chitosan
Table (1) shows the superiority of spraying with Chitosan at a concentration of 1000 mg. L⁻¹ in the characteristics of the number of leaves, leaf width, leaf area, the content of the leaves of carotenoids, nitrogen, phosphorous and potassium and reached 19.12 leaf⁻¹, 17.85 mm, 698.97 cm², 2.15 g / 100 wet weight, 1.71 %, 0.348 %, 2.02 %, while there was no significant difference between the treatments in leaf content of total chlorophyll. As for the triple overlap, the results indicate the superiority of the triple interaction treatment between cold storage for 2 weeks and spraying with chitosan at a concentration of 1000 mg. L⁻¹ in all characteristics, number of leaves, leaf width, leaf area, nitrogen, phosphorus and potassium ratio and reached 21.66 leaf⁻¹ 19.19 mm, 806.07 cm², 1.99 %, 0.368 %, 2.21 %, respectively. The triple interaction treatment was superior between cold storage for 2 weeks and spraying with chitosan 500 and 1000 mg. L⁻¹ in leaf content of carotenoids and reached 2.18, 2.35 g / 100 wet weight, respectively, compared to all treatments.

Table (2) The effect of the duration of cold storage and spraying with chitosan on flowering of *Polianthes tuberosa* L.

| Bulbs storage | Height pedicle | No. flowers | Diameter Flower pedicle | Diameter Flower chitosan mg.L⁻¹ |
|---------------|----------------|-------------|-------------------------|------------------------------|
| Control       | 73.55 c        | 23.44 b     | 7.18 b                  | 26.48 c                      |
| 1 week        | 91.21 a        | 27.22 a     | 8.56 a                  | 33.00 b                      |
| 2 week        | 84.71 b        | 28.22 a     | 8.58 a                  | 35.38 a                      |
| Chitosan mg.L⁻¹ |                |             |                         |                              |
| 0             | 74.50 b        | 23.55 b     | 7.43 b                  | 28.06 c                      |
| 500           | 86.27 a        | 27.33 a     | 8.32 a                  | 32.10 b                      |
| 1000          | 88.71 a        | 28.00 a     | 8.57 a                  | 34.70 a                      |
| Intraction    |                |             |                         |                              |
| 0             | 69.85 d        | 22.66 b     | 6.66 e                  | 23.97 d                      |
| 500           | 76.53 c        | 23.66 b     | 7.56 de                 | 26.96 ed                     |
| 1000          | 74.28 d        | 24.00 b     | 7.33 de                 | 28.52 bc                     |
| 0             | 83.19 bc       | 23.66 b     | 7.71 ced                | 29.03 bc                     |
| 1 week        | 92.36 a        | 29.33 a     | 8.79 ab                 | 31.90 b                      |
| 500           | 98.08 a        | 28.66 a     | 9.18 a                  | 38.08 a                      |
| 1000          | 70.46 d        | 24.33 b     | 7.93 bcd                | 31.18 bc                     |
| 0             | 89.91 ab       | 29.00 a     | 8.60 abc                | 37.45 a                      |
The means per column with similar letters are not significant at 0.05 (Duncan’s multiple range tests). The results presented in Table (2) indicate the superiority of the 1-week storage treatment in the characteristic of the length of the pedicel it reached 91.21 cm, compared to the comparison treatment but the 2-weeks storage superiority in the number of flower, diameter flower pedicel and diameter flower they reached 28.22 flowers 8.58 mm and 35.38 mm respectively compared to the comparison treatment. As for the treatment of spraying with Chitosan, the treatment of spraying with Chitosan at a concentration of 1000 mg was superior. L⁻¹ in the quality of the flower diameter and reached 34.70 mm, while the treatment of spraying with chitosan at a concentration of 500 and 1000 mg. L⁻¹ was superior in the number of florets and the diameter of the floral fennel reached 86.27, 88.71 cm, 27.33, 28.00 flower cluster⁻¹, 8.32, 8.57 mm compared to the comparison treatment. As for the two-ways interaction, the results indicate the superiority of the interaction treatment between cold storage for 1 week, spraying with chitosan at a concentration of 500 and 1000 mg. L⁻¹ and storage for 2 weeks and spraying with chitosan at a concentration of 1000 mg. L⁻¹ in the characteristic of the length of the pedicel 92.36, 98.08 Cm, 93.77 cm, respectively, compared to the rest of the overlaps. The interaction treatment between cold storage for 1 and 2 weeks and spraying with chitosan at a concentration of 500 and 1000 mg. L⁻¹ outperformed the number of florets and reached 29.33, 28.66 flower cluster⁻¹, 29.00 and 31.33 flower cluster⁻¹, respectively, compared to the rest of the interactions. The treatment of the bilateral interaction between cold storage for 1 and 2 weeks and spraying with chitosan at a concentration of 1000 mg. L⁻¹ also outperformed the diameter of the pedicel and reached 9.18 and 9.20 mm, respectively, compared of the interactions between treatment storage for 1 week, spraying with chitosan at a concentration of 1000 mg. L⁻¹. storage for 2 weeks, and spraying with chitosan at a concentration of 500 and 1000 mg. L⁻¹ was superior in the flower diameter and reached 38.08 mm, 37.45, 37.52 mm.

The reason is that the increase in the number of leaves is due to the increase in the storage period and may be attributed to the fact that this period was more appropriate in stimulating growth and increasing the orientation of nutrients and carbohydrates, thus increasing the number and width of leaves and leaf area as a result of increased nutrients and increased vegetative growth. Perhaps the reason is due to the need for alabaster to cool down the temperature, which leads to rapid development and growth [15] and becomes effective the longer it is used [16]. Or perhaps the reason is due to the increase in the number of leaves and the width of the leaf, which was reflected in the increase in the leaf area due to the role of cold storage in increasing the content of gibberellin and its activity in bulbs when cold storage and prolonging the period [17] as gibberellin increases the number of vegetative growth and thus the number of leaves shown the leaf is the leaf space as a result of the increase in photosynthesis. The increase in carotenoids and nutrients is also attributed to the increase in the number of leaves, the width of the leaf and the leaf area, which was reflected in the increase in carotenoids, the nutritional elements N and P K in the leaves, and the increase in the wet weight of the leaves due to the increase in the period of cold storage, which increases the conversion of the complex materials stored in the bulbs into other soluble forms. It is available on the plant and increases with increasing storage time [18]. The reason may be due to the role of cold storage in accelerating flowering [19], as the role of cold storage increases and prolonged in accelerating flowering, and perhaps because of the role of cold storage in the direction of the plant towards flowering through the transformation of vegetative growth into flower growth and increasing the length of the stem. The flowering as a result of deforming the terminal bud growth into a Flower bud [20]. As the vegetative growth characteristics increased, number of leaves, leaf width and leaf area, which was reflected in the increase in flower growth and growth of florets [21].

The reason may be due to the role of chitosan in increasing the chlorophyll content of the plant and protecting the plant from diseases, which is reflected in the plant activity and growth, which is reflected in the increase in the content of sugars and carbohydrates [22], as well as to the increase in chlorophyll in the leaves to the increase in the activity of enzymes, which is reflected in the increase in growth and increase. Characteristics of floral growth and mineral content [23], [24]. Or, the reason may
be due to an increase in carbohydrates, which increases the process of photosynthesis, which was reflected in the increase in total chlorophyll [25].

4. Conclusion
In conclusion, it can be significant response to the cold storage treatment of Polianthus corms, and the two-week storage treatment with chitosan spraying with a concentration of 1000 mg L⁻¹ was given the highest value of all studied traits.

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