

Effect of Sea Algae Extract (AL-Garen) and Growth Medium on Dianthus Flower Production *Dianthus caryophyllus* L.

اثر مستخلص الطحالب البحرية (الجارين) و اوساط النمو على انتاج ازهار القرنفل *Dianthus carphullus*

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ABSTRACT

The experiment was conducted at Kufa Technical Institute in AL-Najaf governorate during the growing season of 2003-2004. The purpose of the experiment was to find out the effect of three growth mediums and three levels of sea algae extract (Al-Garen) which used as spray on characteristics of flowering growth such as length and diameter of pedicel and total percentage of chlorophyll content in leaves. Flowers traits such as flower diameter, petals number and flowering date of Dianthus plants were also investigated.

The three growth medium which used in the experiment were:

- 1- A mixture of 2 parts of loam : 1 part of peat-moss.
- 2- A mixture of 3 parts of loam : 1 part of peat-moss.
- 3- A mixture of 4 parts of loam : 1 part of peat-moss.

The three concentrations of sea algae extract (Al-Garen) which had been sprayed at leaves were 0, 1 and 2 ml/L of water. Randomized Complete Block Design (RCBD) with three replications was used in a factorial arrangement with two factors. Growth medium was the first factor with three levels. The second factor was the concentration of algae extract with three levels. Analysis of variance was performed and Duncan Multiple Range Test (DMRT) was used to compare treatment means at probability level of 0.05. H.E. Dulaymy, J.A. Abbass and H.M. Al-Bakka. Dept. of Horticulture, University of Kufa, Iraq. This study is part of master thesis submitted by the senior author as partial fulfillment for MS degree.* Corresponding author. Results revealed that plants grown in a growth medium of 2 parts of loam:1 part of peatmoss or sprayed by (2 ml/L of water) of Al-Garen concentration had significant improvement in flower growth and flower characteristics compared to other treatments. For example, plants grown in growth medium of 2 parts of loam:1 part of peatmoss or sprayed by a (2 ml/L of water) of Al-Garen concentration had flower diameter of 5.21 and petal number of 31.08 and 28.41 compared with those raised in growth medium of 4 parts of loam:1 part of peatmoss or those plant which were not sprayed with Al-Garen, which produced the lowest flower diameter (4.17 cm and 3.61 cm) and the lowest number of petals (22.29 and 24.79), respectively. It was also found that the interaction of growth medium that consisted of (2 parts of loam:1 part of peatmoss) and sprayed with Al-Garen concentration of (2 ml/l of water) increased flowering yield and flower traits significantly for carnation (stem length, total chlorophyll in leaves, flower diameter and petals number).

المستخلص

نفذت التجربة في المعهد الفني/كوفة في محافظة النجف اثناء الموسم الزراعي 2003-2004 لبيان تأثير ثلاث اوساط نمو وثلاث مستويات من مستخلص الطحالب البحرية (الجارين) على صفات النمو الزهري (قطر الساق الزهري والمستوى النسبي للكوفيل الكلي) والازهار (قطر الزهرة ، عدد البتلات ، موعد التزهير وعمر الازهار بالمزهريه). الثلاث اوساط للنمو التي استعملت هي:

- 1- جزء تربة مزيجية : 1 جزء بت موس
- 2- جزء تربة مزيجية : 1 جزء بت موس
- 3- جزء تربة مزيجية : 1 جزء بت موس

الثلاث تراكيز من مستخلص الطحالب البحرية (الجارين) والتي رشت على الاوراق هي 0 ، 1 ، 2 مللتر/ لتر من الماء. نفذت التجربة بتصميم القطاعات العشوائية الكاملة (R.B.C.D.) بثلاث مكررات كتجربة عاملية بعاملين الاول اوساط النمو بثلاث مستويات والثاني ثلاث تراكيز من مستخلص الطحالب البحرية. قورنت المتوسطات باستعمال اختبار دنكن متعدد الحدود (DMRT) وعلى مستوى احتمال 5%. اشارت النتائج الى ان وسط النمو (2 جزء تربة مزيجية : 1 جزء بت موس) او الرش (2 مللتر / لتر ماء) من الجرين حسنت معنوياً من النمو الزهري وصفات الازهار مقارنة ببقية المعاملات. نمو النباتات في وسط (2 جزء تربة مزيجية : 1 جزء بت موس) او الرش بتركيز (2 مللتر/ لتر ماء) اعطى قطر (5.21 و 5.21 سم) وعدد بتلات (31.08 و 28.41) مقارنة مع النباتات التي نمت في وسط (4 جزء تربة مزيجية : 1 جزء بت موس) او النباتات التي لم ترش بالجارين التي انتجت اقل قطر للزهرة (4.17 و 3.61 سم) واقل عدد من البتلات (22.29 و 24.79) على التوالي. كذلك وجد من التداخل ان النباتات النامية (2 جزء تربة مزيجية : 1 جزء بت موس) ورشت بالجارين بتركيز (2 مللتر/ لتر ماء) زاد من حاصل الازهار ونوعية وميزة الازهار معنوياً للقرنفل (قطر الساق الزهري ، المحتوى النسبي للكوفيل الكلي في الاوراق ، قطر الازهار وعدد البتلات).

Introduction

Roses considered throughout the history as a piece of art. They are the masters of gardens and public parks. Plants and roses are major source of oxygen and have great positive effect on people and environment. Today's, they have economic value in many countries around the world. Many countries export dianthus roses and the income considers a good source of hard currency and economic welfare (1). Dianthus plants are grown in homes, gardens and public parks because of their beauty and attractive colours. Dianthus plants were grown wildy in Europe 400 years ago (2). They spread around the world in present time and used as roses and row material for medicine. To have a good quality and high yield, research should be increased and more information should be obtained. It was found that providing good growth medium such as adding peatmoss to soil resulted in a significant increase in plant height, flowers diameter and number of leaves in dianthus plants compared to those grown in soil alone (3) and (4) reported that growth medium mixture of 3 parts of loam:1 part of peat moss used to grow Tanga variety of dianthus plants led to significant increase in flower diameter and the period of flowering compared to those plants grown in sandy soil. Fertilizers have important effect on growth and flower productivity. (5) reported that adding NPK fertilizer at 3 levels (0, 20 and 40 gm/container) to dianthus plants showed a significant effect on length of stem, flower diameter and average number of petals compared to control treatment. In another study by (1), who found that adding nitrogen in 3 levels (0, 4 and 8 gm urea per container) to dianthus plants in led to a significant increase in length of pedicel to 59.35 cm and significant increase in a diameter of pedicel to 5.22 mm in comparison to the control plants which produced the smallest length and diameter of pedicel. (6) reported that adding K in form of K_2O at four levels (0, 20, 40, 60 gm/m²) to dianthus plants led to improve the flowers production under 60 gm/m² treatment. The same treatment resulted in a significant difference in diameter and length of pedicel compared to the other treatments. (7) investigated the effect of $MgSO_4$ which sprayed on leaves at 3 levels (0, 2000, 3000 ppm) on flower growth of Poinsettia plant *Euphorbia pulcherrima* L., and found a significant increase in growth traits and a decrease the number of day, from planting to flowering stage to 226 days compared to 232 days of the control treatment. In response to importance of nutrition and other agricultural processes on growth and production of dianthus plants, this research had been conducted. The aim was to find out the effect of sea algae extract (Al-Garen) and growth mediums on yield and quality of flowers in dianthus plants.

Materials and Methods

The experiment was conducted in the experimental station of plant production department at Al-Kufa Technical Institute in city of Kufa, Iraq. Dianthus seeds which used in this experiment were from the European variety chaband which have purple colour. It was produced by a famous company named Vilmorin. Planting date was Sep. 20, 2003, and seeds were planted in trays filled with 2 loam:1 peatmoss mixture. This growth medium was treated with Benlate fungicide. Seedlings at age of 25 days which had four real leaves were transferred to container with 25 cm diameter as suggested by (8). Random samples of soil were taken from several locations. The soil samples were mixed and sub sample was taken in order to measure the chemical and the physical properties at Al-Abea center laboratory for agricultural research – Baghdad. Results are listed in appendix number 1. Irrigation, weed, insect and disease control and other services were used to all experimental units equally. At age of 52 days, the stem tips were cut at node number six and plants were left with single stem as suggested by (9). The experimental design used in this experiment was Randomized Complete Block Design (RCBD) with two factors and three replications. The first factor was growth medium with three levels. The levels were 4 loam:1 peatmoss, 3 loam:1 peatmoss and 2 loam:1 peatmoss. The notations for above levels were A_1 , A_2 and A_3 , respectively. The second factor was extract of sea algae (Al-Garen) from Italian company named Green. The three concentrations of Al-Garen were 0, 1 and 2 ml/liter of distilled water. The notation for above three concentrations were B_0 , B_1 and B_2 , respectively. Analysis of variance was performed and Duncan Multiple Range Test (DMRT) was used to compare treatment means at probability level of 0.05 (10). Al-Garen solutions were sprayed at dianthus leaves at three growth stages. The first one

when the plants were 90 days old. The second spray, when plants were 105 days old. The last spray was performed to plant at age of 120 days. Five containers were used for each treatment within each experimental unit (11). At the end of experiment, the characteristics of flower growth such as length and diameter of pedicels were measured by vernier calliper. The total chlorophyll content in leaves was measured by using Aston 85% and according to (12). The flower traits such as flower diameter, average number of petals in each experimental unit, and date of flowering, which determined by number of days from planting to the stage when the 50% flowers were appeared in each experimental units, were recorded.

Results and Discussions

First: Flower Growth Characteristics

Results in table 1 showed significant effect of growth medium on the average length of pedicel and diameter beside the relative content of chlorophyll in leaves. The length of pedicel was 49.52 cm and its diameter was 4.6 cm, while relative content of chlorophyll was 66.7% in plants grown in A₃ growth medium and that was significant when compared to plants grown in A₁ growth medium, which gave the lowest results. The increase in length and diameter of pedicel and relative content of chlorophyll of plants grown in growth medium A₃ was high because of the high percentage of mineral nutrition, high soil capacity of holding water, and good soil aeration in A₃ growth medium (13). The peatmoss medium, in general, has acidic traits (appendix No. 1) which has pH = 6. This is very important to free the microelements and made them available to be absorbed by plants and that led to increase vegetative growth (11). Metabolic processes such as photosynthesis, chlorophyll product, enzyme action and carbohydrate production were increased and that enhanced cell division (14) and finally increased length and diameter of pedicel. Table 1 showed the effect of spraying algae sea solution (Al-Garen) on dianthus plants. A significant increase in length and diameter of pedicel and relative content of chlorophyll in leaves were found. The length and diameter of pedicel was 43.59 cm and 4.25 mm under B₂ level, respectively. The highest chlorophyll content was 68.59% under B₂ situation. In case of B₀ condition, length of flower stem, diameter of pedicel and relative chlorophyll content were 3.75 cm, 3.73 mm and 58.55%, respectively. The reason of that might be due to high nitrogen existence in algae extract (Appendix 3), which enhanced growth and increased cells division and elongation (13, 15 and 16 mentioned that auxins enhanced growth and elongation of plant cells, so high oxygen existence in algae extract and auxins as mentioned above increase length and diameter of pedicels. The increase of chlorophyll because of using algae extract (appendix 3) might be due to increased in the supply of important elements such as nitrogen which led to increase vegetative part and finally increase the photosynthesis process (17) and increase chlorophyll content in leaves. The role of Mg and Fe and other elements was increasing chlorophyll in leaves as reported by (18), who also mentioned that Al-Nahrean nutrient solution increased chlorophyll content in leaves. The interaction between the two factors (growth medium and sea algae extract) was significant in terms of increase the length of pedicel and relative chlorophyll content. The highest length of pedicel was 52.26 cm and the biggest relative content of chlorophyll was 70.75% where plants grown in A₃ growth medium and treated with B₂ concentration compared to the lowest length of pedicel 31.31 cm and the lowest chlorophyll content (58.12%) where plant grown in medium A₁. There was no significant interaction for the above mentioned factors for diameter of pedicel (Table 1).

Second: Flower Characteristics

Table 1 showed a significant increase in flower diameter and number of petals per flower among growth medium levels. The flower diameter was 5.21 cm and number of petals per flower was 30.02 in plants grown in A₃ growth medium. However, flower diameter was 3.61 and number of petals per flower was 22.29 in plants grown in A₁ growth medium. This increase in flower diameter and number of petals per flower might be due to the effect of rich growth medium with nutrition elements as (appendix 1) shows the improvement of soil traits such as increase its capacity to hold water, increase aeration and increase readiness of nutritional elements to be absorbed by roots (8).

Results of what mentioned above increased the efficiency of photosynthesis process, plants absorbed more nutrition elements and increase in flower growth, which led to improvement in flower characteristics such as increase in flower diameter and number of petals per flower (8). This is similar to what reported by (5) and (9), who found significant increase in average flower diameter and the percentage of good petals in Dianthus plants when treated with N.P.K. fertilizer. (1), reported similar results. Table 1 revealed a significant increase in flower diameter and number of petals per flower, in which flower diameter was 5.21 cm and the average number of petals was 27.31 in B₂ level compared to flower diameter of 4.17 cm and number of petals per flower of 24.79 under control condition (spraying distilled water only). The reason of that might be due to the existence of auxins which act as sink to manufactured materials in plants. This led to increase flower diameter and number of petals per flower (16). Similar results reported by (19) and (9) in which supplying plants with sufficient mineral nutrition led to increase carbohydrate yield and finally increase number of petals per flower. Increase in flower diameter and number of petals per flower in dianthus plants was also reported by (1) under condition of spraying Al-Glycyrrhia extract. The interaction of the two factors was significant in term of increase flower diameter and number of petals per flower in which flower diameter was 5.50 cm and number of petals was 30.49 per flower when plants were under condition of growth medium A₃ and extract spray B₂ compared with flower diameter of 3.07 cm and petals number of 20.87 under condition of A₁ and B₀. The growth medium has a significant effect of flowering date and flower age. Delay in flowering date and decrease in flower age were observed in plants grown in growth medium A₃. At A₃ condition, flowering date and flower age were 137.66 day and 3.60 day, respectively. While they were 133.83 day and 4.26 day under A₁ conditions. These results might due to plants grown in growth medium A₃ grew fast and produced more vegetative parts and delay in flowering date occurred (9). Similar results were reported by (11) and (9) who mentioned that adding more nitrogen to plants led to delay in flowering date compared to those grown in control treatment. (20) found that increase nitrogen fertilizer to plants led to increase flower age. Table 1 revealed that using sea algae extract had significant effect on flowering date and flower age, in which they were 136.9 day and 3.53 day under B₂ condition, while control plants had 134.51 day and 4.30 day, respectively. This is due to the role of sea algae extract (Appendix 3) in encouraging vegetative growth and enhancing nitrogen absorption which led to delay flowering date, and this is similar to what (21) reported about the relation between nitrogen fertilizer and flowering date. The interaction between growth medium and Al-Garen treatments was significant in term of flowering date and flower age. Plants grown in A₃ growth medium and sprayed under B₂ concentration resulted in delay of flowering date and decrease of flower age, compared to those grown in A₁ medium and sprayed with distilled water alone, which led to decrease flowering date and increase flower age. Overall, using growth medium (2 loam:1 peatmoss) and spraying 2 ml/l concentration of Al-Garen led to improve flower growth characteristics and flower traits.

Table 1: Effects of growth medium and sea algae extract (Al-Garen) concentrations on growth flowering characteristics and flower traits of Dianthus plants

| Flower age (day) | Flower Traits | | | Growth Flowering Traits | | | Conc. of sea algae extract (Al-Garen) | Growth mediums |
|------------------|----------------------|--------------------|----------------------|--------------------------------|--------------------|-------------------------|---------------------------------------|----------------|
| | Flowering date (day) | No. of Petals/plot | Flower diameter (cm) | Relative chlorophyll content % | Stem diameter (mm) | Flower stem length (cm) | | |
| a 4.26 | c 133.83 | C 22.29 | C 3.61 | C 63.26 | C 3.32 | C 33.58 | | A ₁ |
| B 3.60 | B 136.18 | B 26.39 | B 4.67 | B 65.43 | B 4.05 | B 39.44 | | A ₂ |
| C 3.75 | A 137.66 | A 30.02 | A 5.21 | A 66.70 | A 4.60 | A 49.52 | | A ₃ |
| A 4.30 | C 134.51 | C 24.79 | C 4.17 | C 58.55 | C 3.73 | C 37.51 | B ₀ | |
| B 3.78 | B 136.27 | B 26.60 | B 4.60 | B 68.66 | B 4.00 | B 41.45 | B ₁ | |
| C 3.53 | A 136.90 | A 27.31 | A 5.21 | A 68.59 | A 4.25 | A 43.59 | B ₂ | |
| A 4.57 | G 131.16 | I 20.87 | G 3.07 | H 58.12 | A 3.03 | H 31.31 | B ₀ | A ₁ |
| B 4.23 | F 135.99 | H 22.58 | F 3.77 | E 65.76 | A 3.69 | G 34.03 | B ₁ | |
| C 3.99 | E 135.34 | G 23.41 | E 3.99 | E 65.91 | A 3.69 | F 35.42 | B ₂ | |
| B 4.16 | E 135.28 | F 24.00 | D 4.46 | G 58.39 | A 4.16 | F 35.93 | B ₀ | A ₂ |
| D 3.65 | D 135.99 | E 27.15 | C 4.89 | D 68.81 | A 4.08 | E 39.32 | B ₁ | |
| F 3.00 | C 137.27 | D 28.03 | C 4.94 | C 69.11 | A 3.93 | D 43.08 | B ₂ | |
| B 4.17 | C 137.10 | C 29.52 | C 4.98 | F 59.13 | A 4.90 | C 45.30 | B ₀ | A ₃ |
| E 3.46 | B 137.80 | B 30.07 | B 5.15 | B 70.23 | A 4.67 | B 51.00 | B ₁ | |
| D 3.62 | A 138.09 | A 30.49 | A 5.50 | A 70.75 | A 4.24 | A 52.26 | B ₂ | |

Number with similar letters don't differ significantly according to Duncan Multiple Range Test (DMRT) at probability level of 0.05

Appendix 1: Physical and chemical traits of soil used in this experiment

| Soil physical traits | | Soil chemical traits | |
|----------------------|-------|----------------------|------|
| Sand % | 76.18 | N ppm | 26 |
| Silt % | 14.53 | P ppm | 6.5 |
| Clay % | 9.29 | K ppm | 21.0 |
| pH | 7.88 | Ca ²⁺ ppm | 7.38 |
| EC | 1.98 | Mg ²⁺ ppm | 5.07 |
| Organic matter % | 1.14 | | |

Appendix 2: Content of peatmoss used in this study which was produced by Pindstrug company

| Moisture medium | MgO | K ₂ O | P ₂ O ₅ | N.P.K 24:14:12 | EC | pH | NH ₄ ⁺ | NO ₃ ⁻ |
|-----------------|------|------------------|-------------------------------|----------------|-----|-----|------------------------------|------------------------------|
| 175 ml | 28 g | 240 g | 140 g | 1 kg | 2-4 | 6.0 | 50 gm | 70 gm |

Appendix 3: Content of sea algae extract (Al-Garen) which was produced by Green Italian company

| Mn | Fe | Ca | Mg | Aminic nitrogen | Natural cytokinins | Natural Auxins |
|---------|----------|-----------|-----------|-----------------|--------------------|----------------|
| 7 mg/kg | 11 mg/kg | 650 mg/kg | 165 mg/kg | 0.4% | 0.027 ppm | 10 ppm |

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