Influence of Different Rates of Seaweed Extract on Chlorophyll Content, Vegetative Growth and Flowering Traits of Gerbera (Gerbera Jamesonii L.) Grown Under The Shade Net House Conditions

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Abstract

The experiment was carried out under the shade net house conditions in a private farm located in Al-Diwaniyah city, Al-Qadisiyah, Iraq to investigate the influence of applying different rates of seaweed extract (0, 0.5, 1.0, 1.5, 2.0, 2.5, and 3.0 g/L) on different plant growth parameters and flowers production of gerbera (Gerbera jamesonii L.) plant. Results showed that there were statistically differences in the levels of seaweed extract that applied as a source of organic fertilizer, and also applying seaweed fertilizer has been increased the agronomic traits and number of flowers produced per plant. It can be concluded that applying of seaweed fertilizer at 3.0 (g/L) had beneficial influenced on the growth and flowering production of gerbera plant grown under the shade net house conditions.

Keywords: Gerbera, Seaweed, SPAD, Algae, Shade-net Conditions.

1. Introduction

Gerbera (Gerbera jamesonii L.) belongs to the sunflower family (Asteraceae), is native to South Africa, and is widely utilized as a potted ornamental and used as a cut flower more than planted as a decorative garden plant [1,2]. Gerbera is a perennial herb, was introduced from South Africa into Europe and the United States during the 19th century because of its wide range of color variation, longer flower stalks, and a wide range of flower shades [2,3]. Recently, different gerbera cultivars are planted as one of the important cut flowers for domestic and export market. These commercial cultivars of gerbera can be grown under greenhouse, lath house, low-cost polyhouse and shade net house conditions to produce different flowers in inflorescence quality traits [4].

To increasing plant growth and improving flower production, biostimulants including different types of seaweed and algae are utilized, but little researches have been performed on the ornamental plants including gerbera. Seaweed contains various forms of carbohydrates, amino acids, small amounts of photohormones, proteins, osmoprotectants, and a natural source of macro and micronutrients [5,6]. Applying seaweed extract as biostimulants can improve soil properties and also increase plant growth and yield [7]. In a greenhouse study, it was demonstrated that applying seaweed extract at 1 g/L has been increased flower diameter and flower length of gerbera [8]. Two types of ornamental plants (Gazania and Chinese carnation) grown under the lath house conditions were treated with different rates of seaweed extract (0, 1, and 2 ml/L). Applying high rate of seaweed extract (2 ml/L) increased the chlorophyll content (SPAD) and the total leaf number for both types plants [9]. In a greenhouse study, different rates of seaweed extract (0, 3, and 5 ml/L) and potassium silicate have been applied on potted Tagetes patula plants. Applying high rate of seaweed extract (5 ml/L) increased plant growth and improving flowering quality traits [10]. Foliar-applied seaweed extract can have a positive influence on plant growth and flowering traits of some ornamental plant species, e.g., ornamental pepper (Capsicum annuum L.) [11], tuberose (Polianthes tuberosa L.) [12], and rosemary (Rosmarinus officinalis L.) [13].

In the present study, we hypothesized that an increase in seaweed extract level during seedling of gerbera results in increasing chlorophyll content, biomass production, flower head number, and improving other inflorescence quality traits. We test this hypothesis by carrying out one independent shade net house experiment.
2. Material and Methods

A pot experiment was carried out under shade net conditions in a private farm, Al-Diwaniyah, Al-Qadisiyah governorate, Iraq during the winter 2020 to the end of spring 2021 seasons to explore the influence of different rates of seaweed extract on growth and flowering characteristics of potted gerbera (Gerbera jamesonii L.) cv. Stanza. The gerbera seeds obtained from the Baghdad nursery, Baghdad, Iraq, were planted on the first week of August 2020 and seedlings were transported on the first week of October 2020 to 28 cm plastic pots filled with sandy soil and peat moss with a ratio of 1:1, respectively. Soil samples were taken from each pot before transferring seedlings to evaluate the soil physical and chemical traits. These soil characteristics were shown in Table 1.

| Soil Texture  | Organic matter% | EC (ds.m⁻¹) | Soil pH | N ppm | P ppm | K ppm |
|---------------|-----------------|-------------|---------|-------|-------|-------|
| Silty loam    | 1.9             | 1.6         | 7.8     | 83    | 7.5   | 76    |

The plants were treated with seaweed extract at seven rates (0, 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 g/L), and foliar application was used in this pot study. The seaweed extract was dissolved in a liter of distilled water and a few drops of diffusion matter (Tween-20) before spraying on the gerbera plants. The flowering was started approximately 40 days after transported (DAT), and data were collected in the following six months period. The data included the total number of leaves per plant, chlorophyll content, the flowering stem length (cm), flowering stem diameter (mm), flower diameter (cm), the total number of flowers per plant were recorded.

The SPAD 502 PLUS meter was used to determine the leaf chlorophyll. The three youngest (fully expanded) leaves from each treatment were selected to measure the leaf chlorophyll concentration as SPAD unit. The total number of leaves per plant were recorded.

3. Results and Discussions

The SPAD-502 meter was utilized to measure the chlorophyll content in gerbera plants at 90 days after planting (DAP). Applying seaweed extract as a source of organic fertilizer at different rates showed significantly increased in the chlorophyll content compared to control treatment. The F-test of regression analyses indicated that the predicted leaf chlorophyll trait was significantly influenced by increasing seaweed rates and there was a linear relationship between the chlorophyll content and seaweed fertilizer rate (Figure 1). Similar results were observed in different plant species grown under applying different rates of chemical fertilizers [14, 15]. The number of leaves was also increased by increasing rates of seaweed extract, and there was a linear relationship between this agronomy trait and seaweed fertilizer rate (Table 2). This result comes in agreement with those obtained by [16, 17, 18] on the different ornamental plants. At flowering stage, applying different rates of seaweed extract has been increased the number of flowers per plant (Figure 1) and flowering diameter (Table 2). However, the flowering stem length was reduced by increasing the rate of seaweed extract application (Table 2). The F-test from the regression analysis showed that there was a linear relationship between these flowering traits and seaweed extract rate. Moreover, this statistical analysis suggested that the predicted number of flowers per plants, flowering stem length, and flowering diameter were significantly influenced by applying seaweed extract fertilizer (Table 2). Applying 3.0 g/L resulted in (85%) increase in the total number of flowers per plant over the control treatment (un-fertilized gerbera plants). Tavakoli and Asadi-Gharneh, [8] also reported that applying different rates of seaweed fertilizer to gerbera plant improved different flowering traits, which was similar to our results in this study.

| Plant traits       | Regression formula | Regression type | R²     | NPK rate for maximum value |
|--------------------|--------------------|-----------------|-------|---------------------------|
| Chlorophyll (SPAD) | Y=5.2214X + 30.425 | Linear (positive) | 0.9833 | 3.0 g/L                   |
| Total # of leaves  | Y=3.5000X + 5.2643 | Linear (positive) | 0.9956 | 3.0 g/L                   |
| Total # of flowers | Y=3.3643X + 3.1821 | Linear (positive) | 0.9330 | 3.0 g/L                   |
| Flower stem length | Y=-4.650X + 35.289 | Linear (negative) | 0.9340 | 0.0 g/L (Control treatment) |
| Flower diameter    | Y=11.350X + 59.761 | Linear (positive) | 0.9949 | 3.0 g/L                   |
A

Figure 1. Effect of applying different rates of seaweed extract on (A) chlorophyll content in leaf tissues, and also on (B) total number of flowers per plant.

Conclusion

Applying of seaweed extract fertilizer showed a positive influence on the chlorophyll content, plant growth, and flowering production of gerbera. Applying the level of 3.0 (g/L) showed the highest value for all plant parameters measured (except flowering stem length trait) than other rates applied in this pot study. Therefore, it can be concluded that applying high rate of seaweed extract could be increase the plant growth and flowering production of gerbera grown under the shade net house conditions.

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