EFFECT OF GROWING MEDIA, ORGANIC AND BIOFERTILIZERS ON GROWTH AND FLOWERING OF FREESIA REFRACTA CV. RED LION

By

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B.Sc. Agric. Sci. (Ornamental Horticulture), Fac. Agric., Cairo Univ., 2006

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DEDICATION

I dedicate this work to the spirit of my mother

God rest her soul
Acknowledgment

Thanks to "ALLAH" the merciful and clement God for everything especially completing this work.

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ABSTRACT

Two separate field experiments were conducted on *Freesia refracta* cv. Red Lion throughout two successive seasons (2009/2010 and 2010/2011) at the nursery of Horticulture Research Institute, Giza and faculty of agriculture in Cairo University, Egypt.

The first, aimed to find out the possibility of raising new corms from cormlets under local conditions by studying the individual and combined effects of different growing media (clay, sand/clay (1:1,v/v) and sand/sewage sludge (3:1,v/v) and Actosol levels (0, 2.5 and 5 ml/l) applied as soil drench on growth, flowering, corms and cormlets productivity as well as chemical constituents of leaves and new corms of plants raised from cormlets (1-2 cm circumference).

The second, aimed to study the response of the same plant to different types of natural extracts treatments (garlic extract at 250 and 500 ml/l and active dry yeast at 2.5 and 5 gm/l) for improving plant quality and chemical constituents.

The results emphasized that sand/sewage sludge medium proved its mastery in producing the highest vegetative growth, flowering percentage and best flowers. Also, it gave rise to corms yield, fresh weight of new corms, corms circumference and fresh weight of cormlets. In addition, the same medium was the best for increasing total carbohydrates, N, P and K contents in leaves. Beneficial effects were recorded due to applying Actosol at 2.5 ml/l on vegetative growth height, flower parameters as well as corms and cormlets productivity. Also, it was the best for elevating total carbohydrates in leaves and P% in new corms.

Moreover, The results of the second proved the prevalence of using yeast extract at 2.5 gm/l for improving vegetative growth, most of flower parameters and corms and cormlets productivity. Meanwhile, using garlic extract at 500 ml/l occupied the second rank in elevating No. of cormlets/plot (cormlets yield) and fresh weight of cormlets. Receiving plants yeast extract at 5 gm/l was the best for raising chlorophyll (a and b) in leaves. Also, all treatments tended to increase carotenoids accumulation in the same organ. Great influence was detected on chlorophyll (a) and carotenoids in leaves due to applying garlic extract at 500 ml/l, whereas using garlic extract at 250 ml/l was the best for raising total carbohydrates content in the same organ. N, P and K contents in leaves were also increased as a result of applying yeast extract at 2.5 gm/l. Meanwhile, using garlic at 250 and 500 ml/l showed a favourable effect on N and K% in leaves, respectively. Also, P% content was increased due to applying yeast extract at 5 gm/l. Meantime, total carbohydrates accumulation in the new formed corms was increased due to using the different fertilizer treatments. However, applying yeast extract at 2.5 gm/l raised N and P% content in the same organ. Also, K% content in the new corms was increased as a result of using garlic extract at either 250 or 500 ml/l.

**Key words:** *Freesia refracta* cv. Red Lion, Humic acid, Natural extracts, Growing media.
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INTRODUCTION

Freesia (Family, Iridaceae) is a corms plant discovered and put in cultivation since more than 200 years (Bailey, 1963). It is among the important cut flowers in European countries, U.S.A and Japan. Also, it occupies a considerable place among cut flowers in the Netherlands, besides roses, carnation and chrysanthemum. The freesia flowers are popular in the European markets and could be easily transported since they are light in weight. However, the cultivation of freesia was limited until the beginning of this century because flowers were of few colours. After the introduction of new species and the establishment of many hybrids having a wide variety of colours, freesia has became an important ornamental plant.

Organic fertilizers are of paramount importance for their beneficial effects on the physical, chemical and biological properties of soil, cation exchange capacity and available mineral nutrients for plant productivity (El-Nagar, 1996). However, the opportunities for organic agriculture to affect plant and its occupants in the new century will increase obviously. There is some evidence of variation among organic and conventionally produced crops in their quality (Woese et al., 1997, Zarb et al., 1999 and El-Khouly, 2003).

Among organic residues, sewage sludge proved to have highly beneficial effect on sandy and calcareous soils and has been described as the most suitable organic conditioner for the desert soil (Askar, 1988) and also as a slow release fertilizer in potting media to eliminate the need for additional fertilizer (Gouin, 1994).
Using actosol containing humic acid seems to be valuable in correcting the widespread occurrence of certain nutrient deficiency symptoms. This is attained through increasing the soil water holding capacity, promoting soil structure and enhancing the metabolic activity of micro organisms. They also act as sources of nitrogen, phosphorus and sulfur for plants (Petrovic et al., 1980; Higa and Wididana, 1991). Moreover, Stevenson (1994) concluded that, humic substances isolated from different materials contained 45-65% carbon, 30-48% oxygen, 2-6% nitrogen and 5% hydrogen. Humic substances (HS) are important soil component because they constitute a stable fraction of carbon (C), thus regulating the carbon cycle and release of nutrients including nitrogen (N), phosphorus (P) and sulphur (S). Additionally, the presence of HS improves pH buffering and thermal insulation.

The use of extracts of certain plants referred to as biostimulants, botanical activators or botanicals, such as garlic and yeast (though the latter is a fungus) in improving the growth of agriculture crops specially ornamental plants, is highly recommended as an environment – friendly and safe approach to get better plants without being forced to use chemical nutrients or synthetic growth regulators that may harm the environment. They proved their mastery in most cases for improving most plant traits compared with that gained from other extracts of different plant species.

Therefore, the work embodied in this Thesis aimed to study the effect of individual and combined effects of different types of growing media and organic fertilizer (actosol) on growth, flowering and chemical constituents of *Freesia refracta* cv. Red Lion plant. In
addition, for raising corms from cormlets by studying the effect of different types of natural extracts (garlic and yeast). Also, it intended to get better plants without being forced to use chemical nutrients or synthetic growth regulators that may harm the environment, besides getting a safe and clean product.
1. Effect of growing media on freesia plant

Evidently, growing media play a major role on plant growth and development. They act as plant support, serve as a source of water and essential plant nutrients and permit the diffusion of oxygen to the roots. Growing media also provide a number of functions addition to support for the above ground part-functions that often appear mutually exclusive.

Sewage sludge proved highly beneficial effect on sand and calcareous soils and has been described as the most suitable organic conditioner for desert soil (Askar, 1988) and also as a slow release fertilizer in potting media to eliminate the need for additional fertilizer (Gouin, 1994). However, the ornamental flowering bulbs did not receive considerable attention in this respect.

The following is a review of the results of reversal work conducted by several scientists to investigate the effect of different growing media on plant morphological traits and chemical constituents of several ornamental bulbs plants.

a. Effect of growing media on vegetative growth

Nabih et al. (1987), on Iris cv. Ideal, reported that sandy medium produced the earliest bulb sprouting, the tallest plant at the beginning of plant development and increased the average number of leaves/plant.
Badran (1989), reported that, clay loamy soil produced better quality of vegetative growth of tuberose in comparison with sandy calcareous soil.

Nabih (1991), on *Freesia refracta* cv. Aurora, indicated that sand/composted leaves medium (*Ficus infectoria* trees) produced a favorable growth.

Boon and Niers (1991), on *Iris planifolia*, found that sandy loam soil produced better quality of vegetative growth in comparison with sandy soil.

Manoly (1996), on Iris, demonstrated that all vegetative growth characters such as number of leaves/plant, leaf length and width and leaves fresh and dry weights/plant were significantly increased due to growing plants in a clay loamy soil rather than sandy calcareous soil.

Badawy (1998), on *Polianthes tuberosa*, found that sand/composted leaves medium increased plant height at flowering stage, whereas, clay medium gave the worst results in this concern.

Ingelmo *et al.* (1998), investigated the feasibility of using organic wastes to produce alternative substrates for ornamental plants. They reported that 50% of the peat used in nurseries could be successfully replaced with different mixtures of dry sewage sludge, grape marc, rice hull and pink bark. This led to a reduction in the cost of substrates while not diminishing the quality of plants produced, and using similar amounts of water and nutrients.

El-Fawakhry (2001), on *Polianthes tuberosa*, concluded that the tallest plants were produced by planting bulbs either in a mixture of coarse sand + fine sand + clay or a mixture of coarse sand + fine sand
+ composted leaves (*Ficus infectoria* trees), however, clay medium and its mixture with coarse sand produced the shortest plants.

Nasr (2001), on *Polianthes tuberosa*, claimed that sand/clay mixture resulted in the highest increase in leaf length compared to that obtained from sand/composted leaves medium, while number of leaves/plant was not significantly affected by the growing media investigated (clay, sand/clay (1:1 v/v) and sand composted leaves (*Ficus infectoria* trees) 1:1, v/v.

Manoly and Hassanein (2004), on *Dahlia pinnata*, reported that poultry manure at the high rate (8 m$^3$/fed) surpassed other organic treatments in augmenting different vegetative growth characters.

Hassanein and El Sayed (2009), on Gladiolus cv. Eurovision mentioned that vegetative growth parameters (leaf length, number of leaves/plant and leaves dry weight) increased with increasing the level of added organic fertilizer (0, 4, 8 and 12 l/fed).

Abdel–Sattar et al. (2010), on *Polianthes tuberosa*, reported that sand/compost medium was the best for increasing vegetative growth height followed by that of sand/sewage sludge medium, while the lowest records were due to growing plants in clay medium.

**b. Effect of growing media on flowering**

Kiplinger *et al.* (1966), on Easter lily, concluded that the plants grown in heavy soil were shorter and formed fewer buds than those in any other treatments.

Perry and Box (1972), on *Iris germanica* cv. Pinnacle, reported that the number of flowering stalks and number of flowers/plant were markedly less in sandy than in clay loamy soil.
Holcomb (1984), on Tagetes plant concluded that the beneficial effects of sand/sewage sludge medium on flowering may be due to the active role of such components in improving the hydrophysical properties of sandy soil, in increasing availability and absorption of the nutrient elements which may be necessary for forming precursors of a class of compounds which ultimately forms amino acids and hormones needed for the flower formation and showing colour stimulation.

Hetman et al. (1985), on Freesia, concluded that peat: loam: sand (1:1:1) as standard mixture proved to be satisfactory for Freesia flowers.

Badran (1989), indicated that clay loamy soil effectively delayed flowering time of tuberose in comparison with sandy calcareous.

Manoly (1989), on Polianthes tuberosa, mentioned that flowering stalk length, thickness and weight as well as number and weight of flowers/plant were appreciably improved when plants were grown in clay soil in regard with those grown in sandy soil.

Nabih (1991), on Freesia refracta cv. Aurora, stated that sand/composted dried leaves medium (Ficus infectoria trees) produced favourable flowering.

Boon and Niers (1991), on Iris planifolia, mentioned that sandy loamy soil effectively delayed flowering time in comparison with sandy soil. They added that sandy loamy soil produced better flowering quantity and quality than sandy soil.

Mohamed (1994), on Polianthes tuberosa, reported that plants grown in 1: 1: 1 loam/ sand/ peat (v/v) or 1: 1: 2 loam / sand/ peat (v/v) had generally taller spikes than those in other mixtures. On the other
hand, plants grown in 1: 2: 1 loam/ sand/ peat (v/v) or 1: 2: 1 loam/ sand/ vermiculite (v/v) gave the shortest spike. Growing media had no significant effect on rachis lengths. The greatest number of flowers/spike was obtained from plants grown in 1: 1 loam/ sand/ vermiculite (v/v), whereas the lowest values were recorded on plants grown in 1: 2: 1 loam/ sand/ peat (v/v). The greatest spike diameter was obtained from plants grown in 1: 2: 1 loam/ sand/ vermiculite (v/v). The different growing media had no significant effect on the fresh and dry weights of spikes.

Manoly (1996), on Iris, found that stalk length, thickness and flower length, flower diameter, length and width and fresh and dry weights of flowers were significantly increased by growing plants in clayey soil in comparison with sandy calcareous soil.

Ibrahim et al. (1996), on Freesia cultivar (cv. Aurora) indicated that using medium enriched with chemical fertilization, showed favourable flowering of the plant, whereas, clayey medium gave the worst results.

Badawy (1998), on Polianthes tuberosa, plants grown in three different growing media (clay, fine sand and sand/composted leaves), found that sand/composted leaves medium (1:1, v/v) increased spike stem length, spike stem diameter, number of flowers/spike and fresh weight of cut spike. Clayey medium gave undesirable effects in most cases. Also, sand/composted leaves medium gave a high flowers yield, early flowering date and increased plant height at flowering stage, clayey medium gave the worst results in this respect.
Szlachetka et al. (2000), on Iris, indicated that growing medium (green-house soil, green-house soil + manure (3 : 1), 1:1:1 peat:bark: sand or 1:1:1 peat: bark: green-house soil) had low effects on flower production, spike stem length and diameter and fresh and dry weights of cut flowers.

Nasr (2001), on Polianthes tuberosa, claimed that sand/composted leaves (Ficus infectoria trees) insignificantly induced earlier flowering than that resulted from clay, the sand/clay medium resulted in an intermediate effect in this concern. The mixture of sand with either clay or composted leaves medium revealed the same effect on the number of flowers/spike and approximately the same fresh weight of the spike followed by clayey medium. The highest increment in spike stem diameter was resulted from using sand/clay medium.

Khalafalla et al. (2000), on Ornithogalum thrysoides, stated that using the sand/composted leaves and composted leaves as growing media resulted in significant increase in spike stem length and diameter, rachis length, diameter of the largest flower and fresh weight of the cut spike in comparison with clayey medium.

El-Fawakhry (2001), on Polianthes tuberosa, reported that flowering characters (number of day from planting to flowering, number of cut spikes/plot (flowers yield), spike length, spike diameter, number of florets/spike and fresh weight of the cut spike) were significantly by increased due to planting bulbs in mixture of fine sand/composted leaves, whereas, the clayey medium gave the worst results in this respect.