STUDIES ON PRODUCING CARNATIONS USING DIFFERENT SOILLESS CULTURE SYSTEMS

By

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B. Sc. Agric. Sc. (Biochemistry), Cairo University, 1999

M. Sc. Agric. Sc. (Ornamental Horticulture), Ain Shams University, 2005

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Approval Sheet

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ABSTRACT

Neveen El-Sayed Metwally El-Sayed: Studies on Producing Carnations Using Different Soilless Culture Systems. Unpublished Ph.D. Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2010

The experiment was carried out in the experimental site of Arid Land services and Research Center (ALARC), Faculty of Agriculture, Ain Shams University under unheated plastic house during two successive seasons 2007/2008 and 2008 /2009. The aim of the experiment was to determine the most suitable and economic soilless culture system for producing carnation flowers with high yield and quality, also determined the most suitable plant density per square meter for producing carnations using different soilless culture systems. Rooted cuttings of standard carnations *Dianthus Caryophyllus* cv. "Crimson Tempo" were used in this study. At the beginning of August, the carnation rooted cuttings have been cultivated in net cups filled with perlite: peat mix (2:1 v/v) to help them to form new roots. Then in the beginning of September, the small plants with their net cups were transplanted in the soilless culture systems. Five soilless culture systems were used as follow; aeroponic system (Aero.), Nutrient Film Technique (NFT), Shallow container system “10 cm depth” filled with perlite (C.A), Deep container system “20 cm depth” filled with perlite (C.B) and Horizontal bag system filled with perlite (H.B). Two plant densities were tested as follow; 16 plants /m^2 (PD-1) and 32 plants /m^2 (PD-2). Different measurements were recorded throughout the experimental time; Plant height, shoot and root fresh weights, shoot and root dry weights, fresh and dry shoot: root ratio, number of flowers/plant and number of flowers/m^2, number of days from cultivation to flowering , flower stem length, flower head diameter, flower weight, petiole thickness , the thickness of the flower stem base , vase life, (N, K, P , Ca % in the leaves and carbohydrates % in the stems), water & fertilizer consumption per square meter , water & fertilizer use efficiency and economic assessment for the tested soilless culture

systems. The experiment was arranged in a split-plot design with three replicates. Results illustrated that using aeroponic system recorded the higher vegetative growth parameters, yield quantity and flower quality, chemical parameters, water use efficiency and shorter time from cultivation to flowering than all other tested soilless culture systems. On the other hand, NFT system recorded the lowest vegetative growth parameters, yield quantity and flower quality, water & fertilizer consumption and the longest time from cultivation to flowering. Regarding the effect of plant density, results indicated that there was no significant difference between the both tested plant densities on vegetative growth parameters and flower quality. However using 32 plants/m^2 recorded higher yield, longer time from cultivation to flowering, lower water use efficiency than 16 plants /m^2. Regarding the interaction between soilless culture systems and plant densities, results showed that the interaction between aeroponic system and 32 plants/m^2 recorded the highest vegetative growth parameters, number of flowers/m^2, flower quality and shorter time from cultivation to flowering than all other interactions. Regarding the economic evaluation, results indicated that the interaction between aeroponic system and 32 plants/ m^2 recorded the highest net return, interest rate and shortest payback period.

Key words: Carnation, *Dianthus Caryophyllus*, soilless culture, aeroponics, NFT, container system, horizontal bags, hydroponics, substrate culture, plant densities.

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Aero.	Aeroponic system
NFT	Nutrient Film Technique
C.A	Shallow container system “10 cm depth” filled with perlite
C.B	Deep container system “20 cm depth” filled with perlite
H.B	Horizontal bag system filled with perlite
PD-1	16 plants / m^2
PD-2	32 plants / m^2
S.S	Soilless system
v/v	Volume per volume
MB	Methyl bromide

1. INTRODUCTION

Flowers are prized as objects of great beauty and diversity, commercially valuable (US$ 4.5 billion in international trade yearly) and highly perishable **O'Donoghue, (2006)**. The interest in cut flower cultivation in many countries in Mediterranean is increasing gradually because the internal market demand, climate advantages of the region and increase on the production of cut flower for export in recent years. Carnation is the most diffused cut-flower crop in protected cultivation in the Mediterranean areas, due to its suitability to environmental and climatical conditions **Bunt *et al.*, (1981).** On universal level, carnation is one of the most popular cut flowers; carnations are among the most extensively grown cut flowers in the world and the highest economic importance in the floriculture industry **Nukui *et al.*, (2004)**. However, carnation is very susceptible to soil-borne diseases such as the wilt caused by *Fusarium oxysporum* f. *dianthi*. Since carnation crop normally occupy the beds for periods of 1-2 years and are grown in monoculture, the spread of such diseases can prove disastrous. Thus unless soil-borne diseases are controlled; plant growing becomes a hazard operation filled with risk **Robinson, (1983)**.Occasionally, methyl bromide is used as soil fumigator as many carnation, lily and gerbera producers use methyl bromide in their greenhouses because no other chemical method available has the same broad spectrum of activity **Reis,** (**1998)**. Unfortunately carnation is very sensitive to bromide residues. On the other hand, methyl bromide will not be permitted after few years in Egypt as a result of Montréal environmental agreement because methyl bromide is extremely toxic and environmental harmful **UNEP, (2000)**. As a result of increasing the environmental and health restrictions, there is a lack of soil fumigant available for greenhouse use. This problem added to the high cost of steam sterilization increased the attention on soilless technology as a method for saving the environment**.** Soilless culture has proven to be a viable alternative for cut flower sector in many countries and regions allover the world so soilless production has been introduced for carnation