Evaluation Effect of Different Maintenance Systems on some Ornamental Plants in the North-Western Coast of Egypt

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ABSTRACT

The present study was carried out in North-Western Coast of Egypt in summer resorts of Marina during the two seasons of 2012/2013 and 2013/2014 to study three maintenance systems (technical system, internal management system and specialized company system) on three ornamental plant species (Ficus retusa, Hibiscus rosa sinensis, and Vinca rosea) which were chosen in Marina resorts for evaluation, taking in consideration the effect of these maintenance systems throughout the four climatic seasons of the year on the tested plants. Evaluation of these factors included some plant growth and quality parameters such as plant height, crown diameter, stem diameter and plant performance. The results showed that among the three used maintenance systems, the specialized company system was the most effective followed by the internal management system, then the technical system which gave the lowest values in all investigated parameters. Moreover, the best results were measured in the summer season followed by spring.

INTRODUCTION

A resort is a popular place of entertainment and recreation at which public overnight accommodations are available and if there is no lodging facilities are available; properly it would not be considered as a resort (Wall, 2001). Resorts vary widely in their character and size (Walton, 2000). Resort is not only a place of sun, sand and sea water but also a place with green area. Concerning green area it will affect the resort evaluation either for owners or tourists not as a source of pleasure but also as an income source. In a questionnaire about the landscape design on some resorts in Turkey, 23% of tourists stated that it would have been better if more trees and fewer constructional elements were used (Öguz et al., 2010). In addition, green area share many positive effects; on adults spending time in neighborhood parks, contribute in better mental health, higher levels of physical activity, better overall well-being, and lower levels of stress (Bratman et al., 2012; McCormack et al., 2010 and Roe et al., 2013) and for young people provide numerous benefits for mental health, physical health, cognitive functioning, personal well-being, and socio-emotional development (Chawla, 2015 and Lee et al., 2015). Ornamental plants are also used to control erosion, restore disturbed landscapes, water consumption, reduce energy and improve the aesthetic quality of recreational areas, rural and urban landscapes, interscapes and commercial sites (Cassaniti et al., 2009).

Little information is available about the percent of green areas or maintaining it. Beach resort developments in Egypt face problems due to inability a part of stakeholders to make sound decisions about sustainable designs and a lack of comprehensive decision-making to assist them (Abdel-Latif et al., 2012). On the other side, gardens need from 2 to 3 years of care to rise up plants till plants take the final form. Even after plant maturity, gardens beauty depends on care and maintenance of gardens and the ability of the garden owners to spend money for maintaining their gardens. Maintenance systems include the programs of irrigation, fertilization, pruning, pest management and weeding.

Few studies were done on green area in resorts of the North-Western Coast of Egypt. So, the aim of the present investigation was to evaluate three different maintenance systems and their components on the growth parameters of some ornamental plants during the four climatic seasons during 2012/2013 and 2013/2014 years.

MATERIALS AND METHODS

The present investigation was carried out at the North-Western Coast of Egypt in summer resorts of Marina during the two successful years of 2012/2013 and 2013/2014. The present work aimed to study the green maintenance systems in these resorts and their components. There were five maintenance systems. We suggest names for these systems as follows for ease of use namely:

A. Contractor and ordinary worker served green area (we suggested its name as contractor system).
B. Technical and ordinary workers served green area (we suggested its name as technical system).
C. Engineer, technician and farm workers served green area (we suggested its name as internal management system).
D. Specialized company (Consultant or supervisor, engineer, technicians and agricultural worker) served green area using provisional program (we suggested its name as specialized company system).
E. A government department supervises a maintenance company served green areas (we suggested its name as governmental management system).

The chosen maintenance systems are three (technical system- internal management system and specialized company system) these maintenance systems look like many types of maintenance systems of resorts and widely expanded along the coast as a sample for the study, to evaluate and choose the best of them.

The components of each maintenance system were shown in Table (1), and the data were recorded throughout the four climatic seasons (autumn, winter, spring and summer) of 2012/2013 and 2013/2014 years. These three maintenance systems differ from each other in the responsible for maintenance, method of irrigation and fertilization. The investigated plant species were, Ficus retusa (tree), Hibiscus rosa sinensis (shrub) and Vinca rosea (Perennial).
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Table 1. The components of the three chosen maintenance systems

<table>
<thead>
<tr>
<th>System Treatments</th>
<th>Technical system</th>
<th>Internal management system</th>
<th>Specialized company system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation</td>
<td>Manual by workers using the hose</td>
<td>-sprinkle</td>
<td>-sprinkle and dripping</td>
</tr>
<tr>
<td>-method</td>
<td>-10L/m²/day</td>
<td>-12L/m²/day</td>
<td>-16L/m²/day</td>
</tr>
<tr>
<td>Fertilization</td>
<td>Nitrogen (urea) 48.8 unit/fed in May – June – July- August</td>
<td>-N+P+K+ Trace elements (20+20+20 + Trace elements) (2kg/fed) in July and August.</td>
<td>-Potassium (potassium nitrate) (2unit/fed) in March</td>
</tr>
<tr>
<td></td>
<td>-Phosphorus (super) (8.25 unit/fed) in May- June- July- August.</td>
<td>-Phosphorus (super) (8.25 unit/fed) in March</td>
<td>-Phosphorus (super). (8.25 unit/fed) in November.</td>
</tr>
<tr>
<td></td>
<td>For insects and fungi</td>
<td>-Potassium (potassium nitrate) (2unit/fed) in March</td>
<td>-Phosphorus (super). (8.25 unit/fed) in November and January.</td>
</tr>
<tr>
<td></td>
<td>Only once and (according to needs)</td>
<td>-Nitrogen (Nitrate) (16.75 unit/fed) in May– June-</td>
<td>-Nitrogen (urea) (23.25 unit/fed) in March</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Phosphorus (super) (8.25 unit/fed) in March</td>
<td>-Phosphorus (super). (8.25 unit/fed) in November and January.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pruning</td>
<td>Every 3 months</td>
<td>-Every 3 months</td>
<td>-Every 3 months</td>
</tr>
<tr>
<td>-trees &amp; shrubs</td>
<td>December, 20th -March, 20th June, 20th and September, 20th</td>
<td>December, 20th -March, 20th June, 20th and September, 20th</td>
<td>December, 20th -March, 20th June, 20th and September, 20th</td>
</tr>
<tr>
<td>Weeding</td>
<td>Every 3 months</td>
<td>-Every 3 months</td>
<td>-Every 1.5 months</td>
</tr>
<tr>
<td>Pest management</td>
<td>According to needs</td>
<td>Only once and (according to needs)</td>
<td>For insects and fungi (April- July- August –September)</td>
</tr>
<tr>
<td>Maintenance of irrigation system</td>
<td>Replacing the hose</td>
<td>Every 3 months</td>
<td>Every month maintaining all parts of irrigation system</td>
</tr>
<tr>
<td>Responsible for maintenance</td>
<td>Technician + Operator</td>
<td>Internal management system</td>
<td>Specialized company</td>
</tr>
</tbody>
</table>

The following measurements were taken in the four climatic seasons at December 15th, March 15th, June 15th and September 15th:

1. Increase in plant height (cm) : was measured before and after pruning the plants.
2. Increase in crown diameter (cm) : was measured as an average of two perpendicular dimensions for each plant before and after pruning the plant and the measure between that mean increases in crown diameter, except for Hibiscus rosa sinensis (hedge plant). Crown diameter was measured in cm as an average of two widths for each plant before and after pruning the plant and the measurements between that mean increases in crown diameter.
3. Increase in stem diameter (cm) : was measured exactly above the surface of the soil before and after pruning the plant and the measurements between that mean increases of stem diameter.
4. Plant performance : was estimated through five grades according to the morphological state of plant (leaves) as follows:

* 9 = Good-healthy - No abscission - Pure color.
* 7 = Slightly wilting - Slightly abscission -Ordinary color.
* 5 = More slightly -Partial abscission -Change in color.
* 3 = Wilting -More abscission - More change in color.
* 1 = Wilting - Abscission - Abnormal color.

Statistical analysis:

A split plot design was used in that experiment. Since, the maintenance systems (technician system, internal management system and specialized company system) were the main plot and the climatic seasons (autumn, winter, spring and summer) were the sub-plot. In addition, in each maintenance system four gardens were selected and five plants in each were randomly selected and the means of them were considered a replicate to form 4 replicates in each maintenance system. Mean comparison was achieved by LSD at 5% method according to Snedecor and Cochran (1974).

RESULTS

Effect of the chosen maintenance systems on growth parameters of investigated plant species:

1. Increase in plant height (cm)

Data presented in Table (2) show that the increase in plant height of Ficus retusa, Hibiscus rosa sinensis and Vinca rosa heights was influenced by the three maintenance systems and four seasons during the two years of the experiment. Moreover, the highest increase in plant height values was in summer followed by spring then winter and autumn with the least values. Also, there were non-significant differences in plant height values of all tested plants during the two years in winter and autumn seasons.

2. Increase in crown diameter (cm)

Data presented in Table (3) show that the increase in crown diameter of Ficus retusa, Hibiscus rosa sinensis and Vinca rosa was influenced by the three maintenance systems and the climatic four seasons during the two years of experiment. Moreover, the highest increases in plant crown diameter values were in summer followed by spring then winter and autumn with the least values. Also, there were non-significant differences in crown diameter values of all tested plants during the two experimental years in winter and autumn seasons.

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Table 2. Effect of maintenance systems, climatic seasons and their interaction on the increase in plant height (cm) of *Ficus retusa*, *Hibiscus rosa sinensis* and *Vinca rosa* in resorts of Marina during 2012/2013 and 2013/2014 seasons.

Table 3. Effect of maintenance systems, climatic seasons and their interaction on the increase in crown diameter (cm) of *Ficus retusa*, *Hibiscus rosa sinensis* and *Vinca rosa* in resorts of Marina during 2012/2013 and 2013/2014 seasons.

3- Increase in stem diameter (cm)

Data presented in Table (4) show the increase in *Ficus retusa*, *Hibiscus rosa sinensis* and *Vinca rosa* stem diameter as influenced by the three maintenance systems and four seasons during the two years experiments. Moreover, the highest increase in plants stem diameter value was in summer followed by spring then winter and autumn with the least values. Also, there were non-significant differences in plant stem diameter values of all tested plants in the two years in winter and autumn seasons.

Table 4. Effect of maintenance systems, climatic seasons and their interaction on increase in stem diameter (cm) of *Ficus retusa*, *Hibiscus rosa sinensis* and *Vinca rosa* in resorts of Marina during 2012/2013 and 2013/2014 seasons.

4- Plant performance

Data presented in Table (5) show that improvements in *Ficus retusa*, *Hibiscus rosa sinensis* and *Vinca rose* performance as influenced by the three maintenance systems and four seasons during the two years experiments. Moreover, the best performance in plant values was in summer followed by spring. However, autumn and winter showed lower values for each plant in all the tested maintenance systems in the two years.

Table 5. Effect of maintenance systems, climatic seasons and their interaction on plant performance of *Ficus retusa*, *Hibiscus rosa sinensis* and *Vinca rosa* in resorts of Marina during 2012/2013 and 2013/2014 seasons.
Also, there was significant increase in plants performance values in specialized company system followed by internal management system then technician system of all tested plants in the two years in winter and autumn seasons.

**DISCUSSION**

Gardens need from 2 to 3 years of care to raise up plants till they take the final form. Even after plant maturity, gardens beauty depends on care and maintenance of them and the ability of the garden owners to spend money for maintaining their gardens. Landscape affects the resort evaluation especially the green area of the resorts by tourist and resorts owners. Öğüz et al. (2010) made questionnaires about the landscape design with 100 tourists accommodated at selected resorts in the Belek region in Turkey. Only 23 % of tourist criticized the landscape design of the tested resorts and stated that it would have been better if more trees and fewer constructional elements were used. Ibrahim (2009) stated that in Malaysia landscape industry is still new with few professional and experts who manage the landscape work and maintenance. Also, Ab Sani and Othman, (2012) found the soft scape materials quality based on physical quality of turfs, shrubs and trees including health, fertilizers, soil, sizes and proper handling of these materials, whereas soft scape work quality refer to achieving quality in work sequence, installation technique and maintenance after planting.

**There were five types of maintenance systems and only three types were chosen:**

1- First type (technical system) includes technician and worker and when few number of resort owners received their units and they want to increase the plants in private or public gardens in partnership with the administration. They need a technician supervising the workers to improve the work and the administration will provide them with some funds to provide agricultural technician to supervise the work.

2- Second type (internal management system) includes internal agricultural management and occurs when most of resort owners receiving their units. Their presence in resorts and needs to grow more plants in private gardens so new formats of garden as well as interest with maintenance will increase. In some resorts, agricultural management has existed since the establishment of the resorts.

3- Third type (specialized company system) exists in some resorts which use specialized agricultural companies that carry out the operations of agriculture and maintenance well since construction or after, because of the economic situation of resort owners where availability of money helps in management to do so.

Ibrahim (2009) stated that problems raised from poor maintenance of soft scape include lack of acceptable standards that leads the judgment on the soft-scape quality depending on landscape architect experience, lack of experience to produce, interpret and applying soft scape specification to the ground which eventually leads to discrepancies and error during construction and low standards of maintenance (Reeves, 2000 and Osman, 2005). In Catalonia, home owner maintain their gardens in high percent about 80.3% of all cases (Cubino et al., 2014). In Georgia (U.S.), nearly the similar values were obtained where three of every four owners performe landscape maintenance (Varlamoff et al., 2001), and in Aljarafe (Spain), where 83% of the owners performed up keep (Fernández-Cañero et al., 2011). In Sri Lanka, although more than 35% of the 20 million people of Sri Lanka involved in vegetation, they face problems in home garden production including, inadequate access of water, lack of knowledge, information, and advisory services, shortage of family or hired labor and in abundant research and development on home gardens (Galhena et al., 2013). Family labors including children, elders, and women are involved in home gardening and have particular importance in their management (Sthapit et al., 2004, Torquembiu, 1992) but, depending on the soci-economical status and affordability, home owners may hire wage laborers to cultivate and maintain the home garden that in turn affect the composition and intensity of home garden activities (Maroys, 2009).

In the current investigation three plant species, which represent plant groups that exist in gardens, were selected. They were *Ficus retusa*, *Hibiscus rosa sinensis* and *Vinca rosea*. The effect of the chosen three maintenance systems and different climatic seasons in the two experimental years on some growth parameters like increase in plant height, increase in crown diameter, increase in stem diameter and plant performance were studied. Generally all plant parameters were best in summer and spring seasons in specialized company system followed by internal management system then technical system in the two years. The results showed that the specialized company system was the best as it based on a specialized company with consultants, experienced and specialized technicians. This maintenance system and its components are appropriate in terms of types, quantities and appropriate dates because of accumulated experience and following recommendations. This may include several factors affecting the landscaping potentials of the evaluated plants such as plant species, and season of the years. Allam (2008) found that most of the studied plants showed better growth in summer and spring and this may be due to the good weather which helps to grow best, irrigation and fertilization also, all the maintenance practices are done very well. Similar results were obtained by Shehata (1997) who concluded that most plants like, *Ficus retusa*, *Hibiscus rosa sinensis*, *Myoporum pictum* and *Vinca rosea* under investigation had better growth in spring and summer. This may due to wind which blows strongly in the North-Western Coast of Egypt during winter and early spring (20-25km/hr), while the wind speed decreases in summer (15km/hr) (UNDP/FAO report in 1970). Forty five annuals grown on the beach of Florida were evaluated during the four seasons, they found more than 50% of plants were survived in all seasons (Tjia and Rose, 1987).

**REFERENCES**


