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### Abstract

Title	The Effects of Foliage Plants on Human Physiological and Psychological Responses and Productivity
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(800 words)

People spend a large amount of time in the workplace. In order to make their workplace more pleasant people put plants such as flowers or foliage plants in their rooms. The main objective of this study is to investigate the effects of indoor foliage plants on human physiological and psychological responses and productivity. This objective is further divided into some sub-objectives such as; 1) to investigate the characteristics of tasks in researches of the effects of foliage plants on human; 2) to investigate the effects of the number of indoor foliage plants on productivity, stress and attention; 3) to investigate effects of the number and size of foliage plants on mood, productivity, and perceived air quality (PAQ); 4) to investigate the effects of foliage plants, illuminances and task types on human impressions, stress and performance; 5) to investigate effects of foliage plants on human physiological and psychological responses at different temperatures; 6) to investigate the effects of foliage plants and lighting on human physiological and psychological responses and productivity.

In Chapter 2, general factors that reside in the tasks used in researches of indoor foliage plants were identified. It is found that common characters of the task that foliage plants have affected in experimental researches were task complexity, attention requirement, time pressure, difficulty, duration, creativity, and feedback. The task in foliage plants research should be moderate in complexity, in the attention requirement, in task difficulty, and in task duration. It is also found that foliage plants have more effects on creative task than on short and repetitive work.

In Chapter 3, results of the study on the effects of the number of foliage plants on productivity, stress and attention were presented. It is found that there are significant effects of the number of plants on friendliness, comfort, freshness, and cleanliness. In this experiment, the best number of plants that should be placed in a room sized 9.53 m<sup>2</sup> was seven.

In Chapter 4, the effects of the number and size of foliage plants on mood, productivity, and PAQ were addressed. It is found that the increase in the number of plants could improve the occupant's mood. Secondly, the interaction between the number and size of foliage plants affected PAQ and reaction time. Increase of PAQ is related to the increase in the quantity of greenery up to a certain number and size of the plants.

In Chapter 5, the effect of green coverage ratio (GCR) from the foliage plants and illuminance on perception, impressions, stress and relaxation were addressed. It is found that the impressions on

room conditions are increase with the GCR. Moreover, higher levels of illuminance produce better pleasure, brightness, breeziness and quality impression. Also, the increase in GCR may decrease the level of stress and increase the level of relaxation, the performance on sudoku test and word creation test.

In Chapter 6, the effect of foliage plants on human physiological and psychological responses at different temperatures was addressed. In this study, we have investigated three levels of temperatures within the range of comfort. Satisfactory results were found proving that the presence of foliage plants at an appropriate temperature can induce better attention and meditation, which is useful for increasing work performance and stress reduction.

In Chapter 7, the effects of foliage plants and illuminance on attention, stress and fatigue were addressed. It can be inferred that there is a significant effect of the interaction of the number and size of plants on attention. The results show that the higher number of foliage plants produces better quality impression, better perception of freshness and less boringness than smaller number of plants, and it also can maintain alertness and attention. Moreover, it can be inferred that the presence of plants at a higher illuminance reduces the heart rate, stress and fatigue.

To sum up, recommended room condition that would give optimal human responses and productivity in a 9.5 m<sup>2</sup> working room area are as follows: a room should be provisioned with 6 potted foliage plants, which height are between 25-50 cm, positioned in the front of the room occupant, at his/her visual area. The potted plants can be placed on the desk or on the floor, depends on its height. The working room temperature should be 25°C, and should be illuminated using 800lx LED or fluorescent lamp.

Benefits for a company that can be obtained from the present of foliage plants by applying the above recommended condition would be substantial. These include economical benefits through the increase in employees' productivity, product defective reduction and customer satisfaction. The second benefit is the increase in employees' health, thus reducing the company's spending. The third benefit is energy saving. The next benefit is the increase in company's "green" image. Moreover, it may increase company's share value.