



## **Plants enhance productivity in case of creative work**

### **Results of a laboratory experiment in The Netherlands**

Dr. John Klein Hesselink (TNO Work & Employment)  
Prof. Dr. Bert van Duijn (Fytagoras BV)  
Ing. Sandra van Bergen (Fytagoras BV)  
Dr. Madelon van Hooff (TNO Work & Employment)  
Ir. Eric Cornelissen (TNO Building and Construction)

In the last fifteen years many scientific studies confirmed the beneficial effects of plants in working situations on the health, well being and productivity of working people. Field experiments mainly indicate that placing plants in working situations increase the health status and well being of the workers. Laboratory experiments indicate that plants also enhance task performance of students in the case of association (creative) tasks, but not in the case of production tasks. The theoretical explanation for these results is that plants have a restorative effect on human beings. The restorative mechanism is more effective in the case of creative work, where a good mental and physical condition enhances an open state of mind for generating solutions. In the case of production work this state of mind distracts people from doing their tasks. But production workers can also benefit when the plants are placed in common rooms such as entrance halls and company restaurants. Because creative work is more general in the service oriented western economies, placing plants in work environments can have a direct positive effect on the economic and company output of these countries.

In June 2007 a laboratory experiment was held at TNO in The Netherlands (Fytagoras BV) to test the effect of plants on task performance. This study was financed by the Product Board for Horticulture (Productschap Tuinbouw), and carried out as a joint initiative of TNO and the Section Interior design (Vakgroep Interieurbepanting) of the VHG (Dutch association for horticulturists and growers). Eighty four students (age 18 thru 28) performed two types of tasks: production tasks by marking letters f and t in a number of randomly presented texts, and association tasks by generating synonyms related to a number or randomly presented concepts (such as sports or ball games). The tasks were carried out in a room without plants, a room with one potted green plant of about one and a half meter high, and a room with a number of potted green and flowering plants. Plants were placed in direct sight of the students. Rooms and tasks were assigned randomly to the subjects and numbers and percentages of (correct) rules and associations were counted and calculated. A placebo condition was included for scientific reasons.

### *Overall effects*

The results of these experiment indicate that the percentage of correct associations in the rooms with plants is significantly higher then in the room without plants ( $p=.019$ ). Figure 1 indicates the percentages per room. The difference between the room without plants and the room with one plant is significant ( $p=.021$ ), and also the difference between the room without plants and the room with many plants is significant ( $p=.036$ ). No differences are found between the two rooms with one and many plants. No differences between the rooms are found for the production tasks and also the placebo condition has no influence.

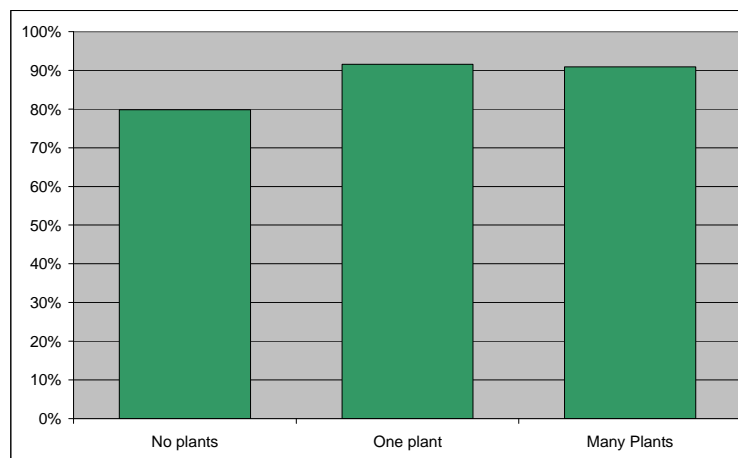


Figure 1: Mean percentage of correct associations (creative tasks)

### *Subgroup analysis*

All students completed a questionnaire before the start of the experiment, with questions on the personal situation, the study situation, and the work situation (if applicable). It appeared that the physical and mental condition of the students, as measured by the questionnaire, is related to the task performance in the rooms with plants. But again the results were only found for the creative tasks. No effects were found for the production tasks. The relationships are presented hereafter.

### *Physical exhaustion*

The questionnaire included six questions on physical exhaustion. Based on the answers, all students were assigned to two groups indicating physical exhaustion, yes or no. The effect of the plants is only significant in the exhausted student group. Figure 2 shows the mean numbers of correct associations per room, for the exhausted group. Again the figure shows more correct associations in the rooms with one and many plants, compared to the room without plants ( $p=.039$ ).

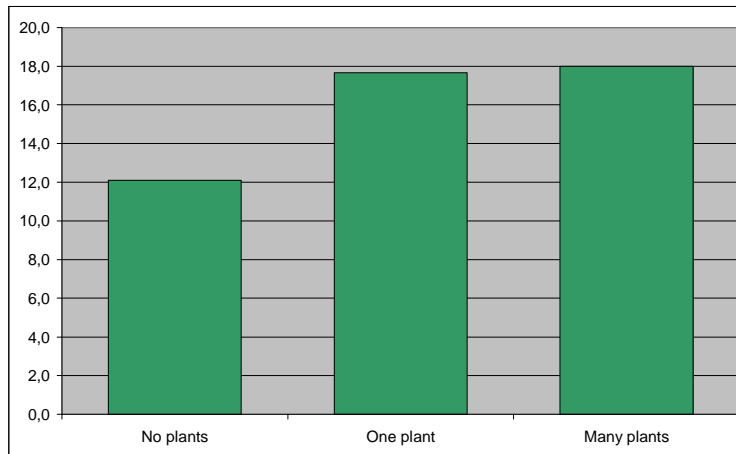


Figure 2: Mean number of correct associations by students with a high score on self-reported physical exhaustion

### Work stress

Students having a paid job next to their study (most students in The Netherlands have) completed eleven questions on work stress. Based on the answers, all working students were assigned to two subgroups indicating work stress, yes or no. Students with high work stress scores significantly benefit from the presence of a plant in the room where the creative tasks are performed ( $p=.032$ ). Figure 3 indicates that the number of correct associations is significantly higher in the room with one plant ( $p=.025$ ), but not in the room with many plants ( $p=.289$ ), compared to the room with no plants.

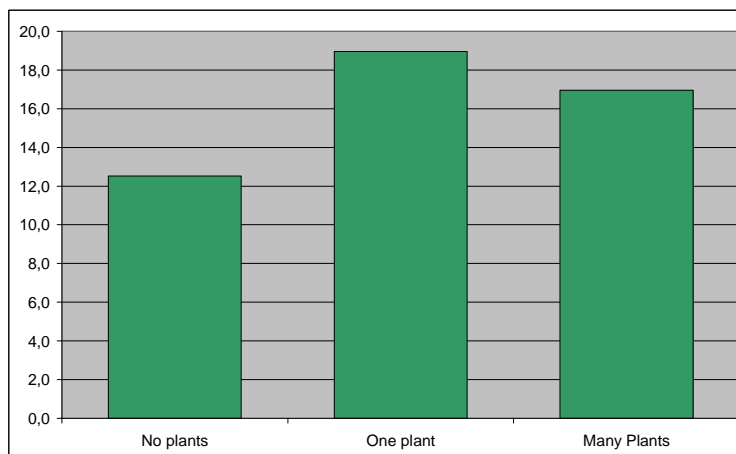


Figure 3: Mean number of correct associations by students with a high score on self-reported work stress

### Summary of results

The results of this laboratory experiment indicate that plants have a positive effect on the productivity of students performing creative tasks, but not in the case of production tasks.

Productivity however is not related to the number of plants in the room. The study also confirmed the restorative effect of plants. Subgroups of physically exhausted students and students indicating high levels of work stress benefit from plants in the room where they perform their tasks. Students in a good physical or mental condition do not need plants to improve productivity in creative tasks.

*Consequences for the working situation of people*

In this experiment we tried to duplicate real life situations of people doing creative and production work in companies. Translated to real life working situations, the results of this study mean that in the case of creative work people benefit from the presence of plants in their direct environment. Placing plants in production environments does not enhance productivity.

*Conclusion*

Placing plants in working environments has, next to the already proven beneficial effects on health and well being of workers, also a positive effect on productivity in the case of creative work. Schematically we can present the results of this study as follows.

*Effects of plants in working environments on productivity*

Working environments with:	Production work	Creative work
- no plants	○	○
- one plant	○	++
- many plants	○	+

---

For more information on this study please contact: TNO, John Klein Hesselink (+31 23 5549 459 / [John.KleinHesselink@tno.nl](mailto:John.KleinHesselink@tno.nl)), or VHG, Mariken Broekhoven (+31 30 6595 643 / [M.Broekhoven@vhg.org](mailto:M.Broekhoven@vhg.org)).