EXAMINATION OF SOIL FERTILIZERS IN *SPATHIPHYLLUM WALLISII* REGEL PRODUCTION

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Abstract

During our work, three kinds of soil fertilizers Austrian Volldünger® Linz, Hungarian FitoHorm® Complex Plus and FitoHorm® for potted plants were applied in *Spathiphyllum wallisii* Regel production. Two experiments were set up. First the effects of the two FitoHorm agents were examined on the leaf size. In the second experiment, FitoHorm agents and Volldünger were compared, leaf size, chlorophyll content, fresh and dry weight were measured. The FitoHorm agents did not significant difference regarding the leaf size, but the groups treated with FitoHorm were bushier. In the second experiment, Volldünger and FitoHorm Complex Plus significantly increased the chlorophyll content comparing to the control. None of the treatments showed significant difference regarding the leaf length and width, fresh and dry weight comparison to the control or each other. Best dry weight rate was measured by Volldünger treatment. In conclusion, Volldünger® Linz, FitoHorm® Complex Plus and FitoHorm® for potted plants had positive effects on vegetative growth and chlorophyll content, therefore these agents can be recommended in ornamental plant production.

Keywords: *S. wallisii*, soil fertilizers, potted plants.

Introduction

The sustainability of agricultural systems is an important global issue (CHENG ET AL, 2010). Fertilizers represent a wide array of materials added to soils to improve plant growth and able to supply nutrients. Plants use these nutrients to make components such as proteins or carbohydrates. Fertilizers are applied to root zones or spray directly on foliage (TRAUNFELD AND NIBALI, 2013, GELLINGS AND PARMENTER, 2016).They can include manures, plant residues and also essential elements (ALLEY AND VANLAUWE, 2009).The quality and quantity of applied fertilizers are key factors affecting the growth and quality of flowers (CHENG ET AL, 2010). Using manures and chemical fertilizers as a supplementary and complementary nutrition additions remain the alternative solution for growers to protect the soil health (KHANAM ET AL, 2017). In the last decades, there were several researches with using soil and foliar fertilizers in ornamental plant production. Fertilizers are applied to tropical potted plants at high rates (BROSCHAT, 1995). Soil and foliar fertilizers significantly increased the plant height, leaf area, plant health, vigor and colour on *Heliconia psittacorum* L.f. (LINARES-GABRIEL ET AL, 2016). Sulphur fertilizer had positive effect on *Aloë vera* (L.) Burm.f. (EISA ET AL, 2014). Sangral foliar fertilizer showed significant increase in the growth parameters and also stimulated the flowering parameters on *Dianthus caryophyllus* L. (EL-NAGGAR, 2009). Nitrogen fertilizer significantly increased the chlorophyll content and leaf size of *Philodendron andreanum* Dwansaye (BO ET AL, 2010). Chemical fertilizers (high concentration of nitrogen) found suitable for growth and productivity in *Chlorophytum tuberosum* (Roxb.) Baker (SHARMA AND KUMAR, 2011). Biofertilizers had positive effects on number of leaves, size of spadix and chlorophyll content on *Spathiphyllum* 'Illusion' (ABBASNIAYZARE ET AL, 2012). The main aim of this study was to examine the positive effects of FitoHorm® Complex Plus, FitoHorm® on potted plants and Volldünger® Linz on *Spathiphyllum wallisii* Regel.

Material and methods

The examination was carried out in the greenhouse of the Department of Floriculture and Dendrology, Corvinus University, Budapest (BCE), in autumn 2013. The processing of samples was performed in the labour of the Department of Floriculture and Dendrology, Corvinus University, Budapest. *Spathiphyllum wallisii* Regel is a very popular foliar plant (SARDOEI, 2014). It is shade tolerant with dark foliage and white spathes (HENRY ET AL, 2004). During this work, three kinds of soil fertilizers such as Hungarian FitoHorm® Complex Plus, FitoHorm® for potted plants and Austrian Volldünger® Linz, were compared. FitoHorm® Complex Plus is a chlorine-free, water-soluble soil conditioner. It is enriched with microelements, applied in ornamental plants and vegetable production. It can also be spread through the foliage and soil (www.fitohorm.hu). FitoHorm® for potted plants is also chlorine-free and liquid nutrient solution. It is enriched with microelements, specially developed for potted plants. It helps to eliminate the leaf chlorosis and fall of leaves (www.fitohorm.hu). Volldünger® Linz is a water-soluble solid soil fertilizer. It is enriched with microelements, applied in viticulture, ornamental plants, fruit and vegetable production. It could be a starter and foliar fertilizer (www.kwizda.hu). The first experiment was started on 2nd October 2013 and the second experiment was started on 6th February 2015 with the division of shoots from stock plants in the greenhouse of the Department of Floriculture and Dendrology, BCE. Shoots were planted into ASB Greenworld® Potting Soil (pH 5.0-6.5, 50-300 mg/l N, 40-300 mg/l P_2O_5 and 80-500 mg/l K_2O) and 12 cm diameter containers. The treatment groups can be seen in *Table 1*. In the first experiment every treatment groups contained 5 plants in 4 repetitions and in the second experiment every treatment groups contained 5 plants in 3 repetitions. The plants were treated once a week with 150 ml mixture of fertilizers and water.

Table 1.The treatment groups

First experiment			Second experiment		
Treatment groups		Concentration	Treatment groups		Concentration
1.	Control (CØ)	-	1.	Control (CØ)	-
2.	FitoHorm Complex Plus (FHC)	1 g/l	2.	FitoHorm Complex Plus (FHC)	1 g/l
3.	FitoHormfor potted plants (FHP)	9 ml/l	3.	FitoHorm for potted plants (FHP)	9 ml/l
			4.	Volldünger (V)	1 g/l

In the first experiment, the morphological characteristics such as leaf length and leaf width were measured. In the second experiment additional parameters: fresh and dry leaf weight was also measured. With the chlorophyll content the physiological conditions were examined. For determination of fresh and dry leaf weight, 3 plants were separated from each treatment group. The root system was cut by the root neck; the whole green plant was measured with Mettler Toledo J 1502G scale. Green organs were dried out at 80 °C temperature in dry heat oven (Binder) for 24 hours and after that they were measured again with the same scale. The relative dry content was calculated based on the ratio of these values. To determine chlorophyll content, 100 mg of leaf sample were collected. The samples were homogenized with quartz sand and completed with 80 % acetone solution to 10 ml. After 24 hour rest the light absorbance of the solution was measured on 663, 644 and 480 nm wave length with spectrophotometer (Genesys™ 10 Vis) (HORVÁTH AND ERDEI, 2003). Statistical analysis was performed by IBM® SPSS STATISTICS (Version 23) by 95% significance level. One-way ANOVA model was used to compare the varieties. The assumptions of homogeneity of variance were hold. Normality of residuals was proved by Kolmogorov-Smirnov test. Pairwise comparisons were run by Tukey's Post Hoc test (TABACHNICK AND FIELDS, 2013).

Results and discussion

First experiment

In the first experiment, the morphological characteristics with leaf length and leaf width measurements were examined. We were not able to detect significant differences between the treatments groups in leaf length [F(2;57)=0.619; p=0.542]and leaf width [F(2;57)=1.988; p=0.146]at the beginning and also at the end of the experiment (leaf length [F(2;57)=0.759; p=0.473], leaf width [F(2;57)=1.226; p=0.301]) *(Figure 1 and 2.)*. The longest leaves were obtained in group which treated with FitoHorm for potted plants. At the last measurement, the control group became 0.9 cm longer, while the FHC group 1 cm and FHP group 1.1 cm longer. The widest leaves were obtained in control group. In practical aspect these results are not mentionable, do not improve the quality.

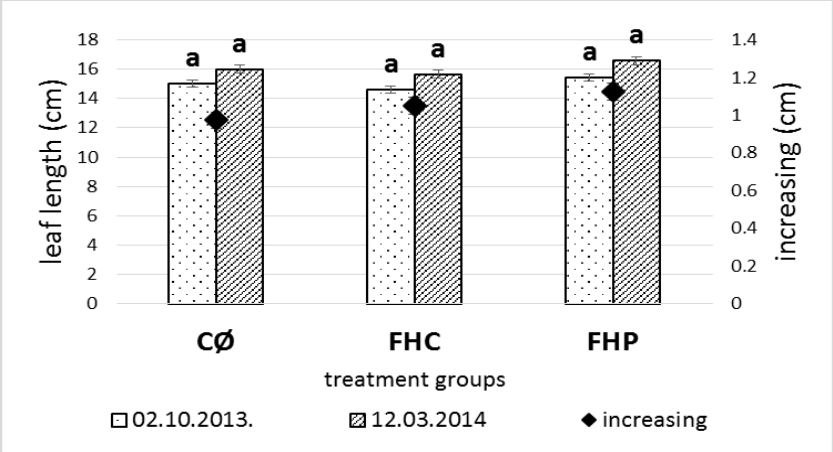

Figure 1. The leaf length of Spathiphyllum wallisii Regel

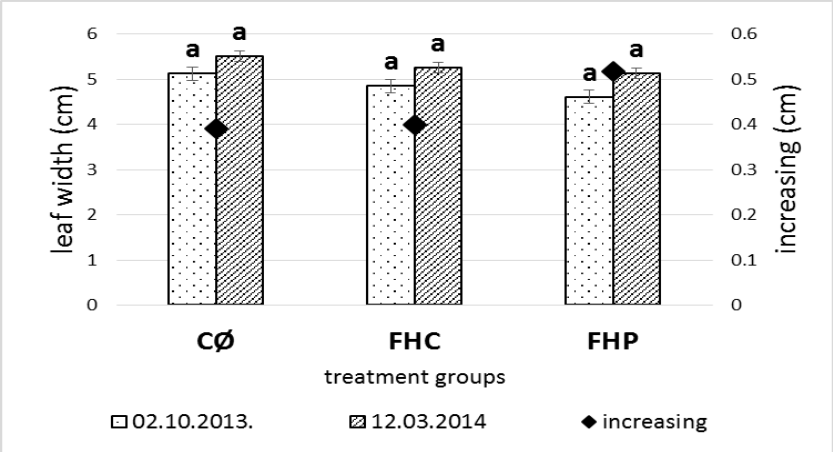

Figure 2. The leaf width of Spathiphyllum wallisii Regel

Despite of the fact than there were no significant differences between treatments groups, foliage development was observed in groups which treated with FitoHorm. Those groups were bushier than the control plants (*Figure 3.*).

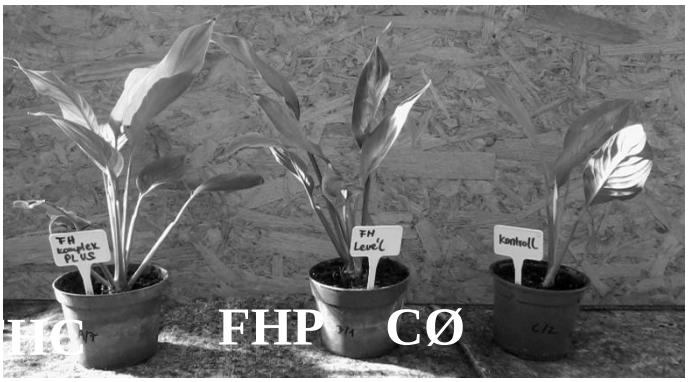

Figure 3.The most typical plants of the treatment groups.

Development of flower initiations was not statistically evaluable, but some trends were observed in the treatment groups. The flower initiations were developed at similar rates in groups which were treated with FitoHorm. In these groups five flowers were developed during five months. Deformation and pigmentation were observed on these flowers. There was no abnormality in the control group.

Second experiment

In the second experiment, in addition to leaf length and width, root mass, fresh and dry leaf weight and chlorophyll content were also measured. None of the treatments groups showed significant differences regarding leaf length [F(2;57)=0.519; p=0.545] and width [F(2;57)=1.958; p=0.148] *(Figure 4. and 5.)* at the beginning and at the end of the experiment (leaf length [F(2;57)=0.779; p=0.476], leaf width [F(2;57)=1.236; p=0.303]). Group treated with FitoHorm Complex Plus gave the best results at both of the measurement time on leaf length and width.

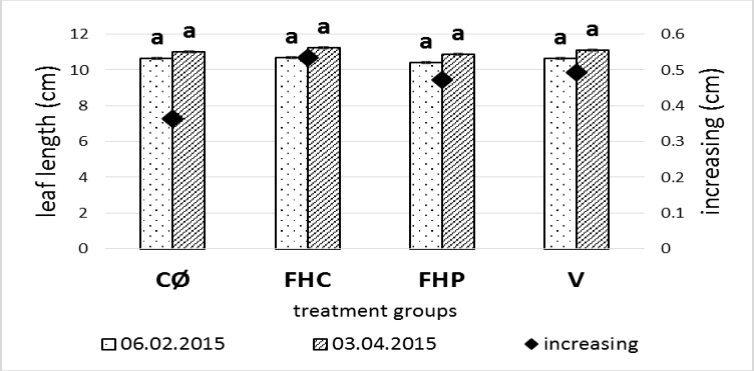

Figure 4. The leaf length of Spathiphyllum wallisii Regel.

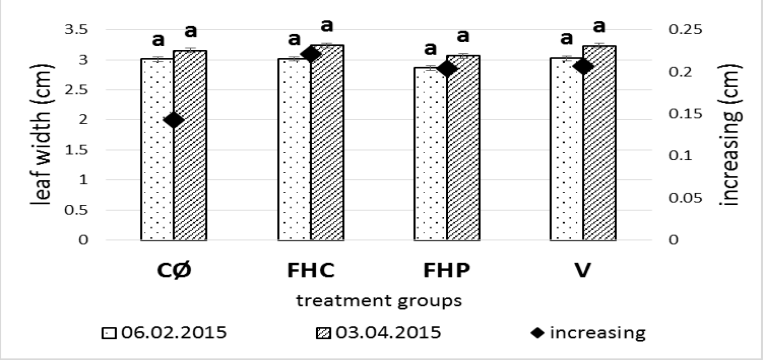

Figure 5. The leaf width of Spathiphyllum wallisii Regel.

All treatments increased the chlorophyll content in the leaves of *S. wallisii* (*Figure 6.*). FHC and V groups showed significant differences in comparison to the control group [F(3;16)=6.660; p=0.004]. Chlorophyll content had 50% increase in groups treated with FitoHorm Complex Plus and Volldünger. From the practical aspect these results are worth mentioning and the may improve quality and physiological conditions.

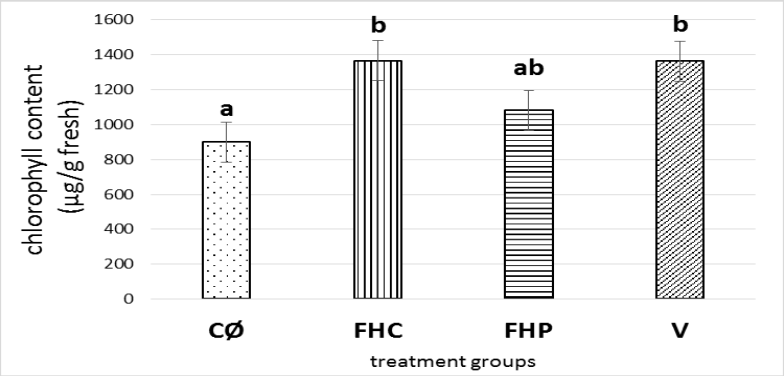

Figure 6. The chlorophyll content of Spathiphyllum wallisii Regel.

As Figure 7. demonstrates there were no significant differences between treatment groups regarding fresh [F(3;50)=2.306; p=0.088] and dry leaf weight [F(3;47)=2.908; p=0.044]. The differences of fresh weight were quite minor, only a tenth of grams. The control group had the best result. The trends were the same for dry weight, but there were some deviations in the ratios. Differences between the two FitoHorm agents decreased. While examining the rate of fresh and dry weight, the lowest rate was observed in the group treated with FitoHorm for potted plants and the highest rate was in the group treated with Volldünger. Plants treated with Volldünger contained the lowest amount of water.

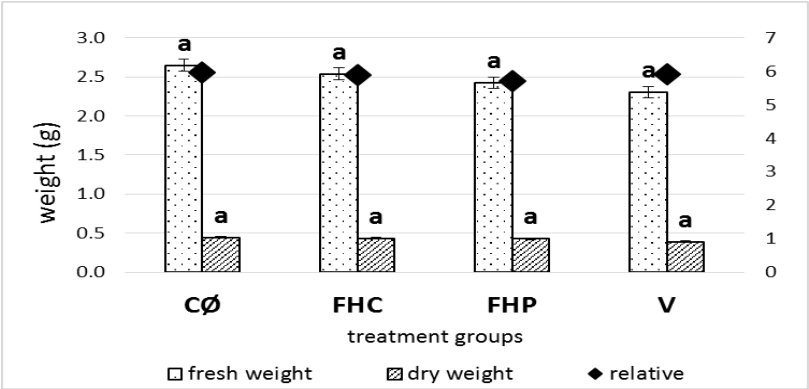

Figure 7. The fresh weight, dry weight and fresh/dry of Spathiphyllum wallisii Regel.

Conclusions

In the first experiment, the groups, treated with two kinds of FitoHorm agents, were bushier than the control group in spite of the results of the statistical analysis. Trends were observed in flower formation. Flowers of the treated groups developed at same rates, but deformation, discoloration and scorching occurred.The control group had the largest number of flowers and there was no deformation. These are important aesthetic aspect of ornamental plants by which the plants are classified in quality category during sale. The treatments did not have a positive effect on generative development. Appropriate treating volume could play a role in the experiment. Probably, the weekly treated prescribe concentrations were too undiluted. To summarize the first experiment, in which the FitoHorm agents, where used beneficial effect on the vegetative growth were noticed. A lower concentration is recommended for healthy flowering. In the second experiment, the leaf growth was

similar, but the change was not considerable in the first experiment. FitoHorm Complex Plus and Volldünger had significantly differences on chlorophyll content. Our results are important in practical aspect because of the more active photosynthesis increases the plant productivity. There was no significantly differences between treatment groups of fresh and dry weight.Summarizing our measured parameters for bushier stand, it is worthy to using one of these agents. Based on the second experiment, the best is the Volldünger or FitoHorm Complex Plus. These agents had beneficial effects on intensive vegetative growth and chlorophyll content. Nevertheless, a lower concentration or water treatment between treatments are recommended. Further experiments suggested for determine of the optimal concentration.

References

1. ABBASNIAYZARE, S. K., SEDAGHATHOOR, S., DAHKAEI, M. N. P. 2012. Effect of biofertilizer application on growth parameters of Spathiphyllum illusion. *Amer-Eurasian J Agric Environ Sci*, *12*(5): 669-673.
2. ALLEY, M. M., VANLAUWE, B. 2009. The Role of Fertilizers in Integrated Plant Nutrient Magamenet. International Fertilizer Industry Association and Tropical Soil Biology and Fertility Institute of the International Centre for Tropical Agriculture. Paris. p. 15.
3. BO, S., RUIXIA, L., JILI, Z. 2010. Studies on Effects of Foliar Fertilizer on the Ornamental Characteristics and Electrolyte Leakage of *Philodendron andreanum*. Ch. Agric. Sci. Bulletin, 4, 49.
4. BROSCHAT, T. K. 1995. Nitrate, Phosphate, and Potassium Leaching from Container-grown Plants Fertilized by Several Methods. HORTSCIENCE 30(1): 74–77.
5. CHENG, K. H., WU, R. Y., CHUANG, K. C., HSIEH, T. F., CHUNG, R. S. 2010. Effects of chemical and organic fertilizers on the growth, flower quality and nutrient uptake of *Anthurium andreanum*, cultivated for cut flower production.Scientia Horticulturae 125 (2010): 434–441.
6. EISA, E. M., IDRIS, T. I. M., WARRAG, M. O. 2014. Influence of Sulfur Fertilizer on Growth and yield of *Aloe vera* plants. Sudan Journal of Science and Technology (2014) 15(1): 65-73.
7. EL-NAGGAR, A. H. 2009. Response of *Dianthus caryophyllus* L. plants to foliar nutrition. *World Journal of Agricultural Sciences*, *5*(5): 622-630.
8. GELLINGS, C. W., PARMENTER, K. E. 2016. Energy efficiency in fertilizer production and use. Efficient Use and Conservation of Energy, Vol II. p: 123-136.
9. HENNY, R. J., NORMAN D. J., CHEN, J. 2004. Progress in ornamental aroid breeding research. Annals of the Missouri Botanical Garden 91: 465-473.
10. HORVÁTH G., ERDEI S. 2003. Növénybiokémiai és növényélettani gyakorlatok [Plant biochemical and plant physiological practice]. Budapesti Közgazdaságtudományi és Államigazgatási Egyetem, Kertészettudományi Kar, University notes. p: 26.
11. KHANAM, R., KUNDU, D., PATRA, S. K. 2017. Integrated Nutrient Management on Growth, Quality, Yield and Soil Fertility of Gladiolus in Lower Gangetic Plain of India. International Journal of Current Microbiology and Applied Sciences (2017) 6(4): 453-459.
12. LINARES-GABRIEL, A., LÓPEZ-COLLADO, C. J., TINOCO-ALFARO, C. A., VELASCO-VELASCO, J., LÓPEZ-ROMERO, G. 2016. Application of biol, inorganic fertilizer and superabsorbent polymers in the growth of heliconia (*Heliconia psittacorum* cv. Tropica). Revista Chapingo Serie Horticultura, 23 (1): 35-48.
13. SARDOEI, S. A. 2014. Evaluation chlorophyll contents assessment on *Spathiphyllum wallisii* Regel with plant growth regulators. International Journal of Biological Sciences 01: 35-39.
14. SHARMA, H., KUMAR, A. 2011. Effect of plant growth regulators and chemical fertilizers on growth and productivity of *Chlorophytum tuberosum* and *Pergularia daemia*. Journal of Medicinal Plants Research, 5(13): 2647-2651.
15. TABACHNICK, B. G., FIDELL, L. S. 2013. Using Multivariate Statistics. 6th edition. Boston: Pearson.
16. TRAUNFELD, J., NIBALI, E. 2013. Soil Amendments and Fertilizers - Fertilizing Guidelines Included by Plant Group. Home & Garden Information Center. University of Maryland. 2013 43: 1-8.
17. http://fitohorm.hu/termekek/fitohorm-komplex-plusz-mutragya/ (21.06.2017)
18. http://fitohorm.hu/termekek/hobbi/fitohorm-leveles-disznovenyekre/ (21.06.2017)
19. http://www.kwizda.hu/volldunger_linz_classic (21.06.2017)