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RESEARCH ON THE EFFECT OF THE FERTILIZATION REGIME ON DECORATIVE AND MORPHO-ANATOMIC PECULIARITIES OF *PITTOSPORA TOBIRA* PLANTS

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Abstract

It is known that the nutrition regime is strongly influencing the plant`s productive potential. The present work continues with an older theme, with works that have enjoyed a very good international appreciation. The species subject to the observations in this paper was Pittospora tobira, much appreciated for its distinctive decorative qualities. Plants, obtained by knockout, were fertilized with three different products: Osmocote, Almagerol and Atonic. The elements of growth and development of plants were studied and recorded dynamically at the macroscopic and microscopic level. For all the observation series and the monitored elements, the Osmocote fertilizer is strongly influenced. This has led to significant increases in the quantitative aspects of plant organs observed both at macroscopic and microscopic levels. Regarding the qualitative aspects of growth, it was found that Almagerol and Atonic products determined the highest values, especially at microscopic level.

Key words*: Pittosporum, fertilizer, growing, plants, observations.*

INTRODUCTION

Pittosporum is one of the most appreciated indoor floral plants (Șelaru, 2006). The beauty of the foliage and the perfume of the flowers are qualities appreciated equally on the plant (Toma, 2009). Although it is appreciated and cultivated primarily for decorative qualities, *Pittosporum tobira* is the topic of several and various research across the world.

Min Chung et al. (2009) are studied the larvicidal effects of the major essential oil of *Pittosporum tobira* against *Aedes aegypti* L.

Rodrigues Frederico et al. (2007) reported the volatile components of the leaf, flower, and fruit volatile oils of *Pittosporum tobira* grown in three locations in Portugal. Maoka et al. (2006, 2008) reported the isolation and structural elucidation of novel carotenoids from the seeds of *Pittosporum tobira* in Japan.

The essential oil from *Pittosporum tobira* (leaves) shows that target sites other than those used by antibiotics will be active against multidrug-resistant microbial pathogens (Lee CK et al., 1998). Fujiwara et al. (2001) reported the isolation and structural elucidation of new carotenoids from the seeds of *Pittosporum tobira*.

Christine L. Wiese et al. (2009) studied the effects of irrigation frequency during establishment on growth of *Pittosporum tobira* '*Variegata'*. Komei Kondo et al. (2002) studied the regeneration of multiple shoots from hypocotyl sections of *Pittosporum tobira* on woody plant medium supplemented with differing concentrations of thidiazuron and naphthaleneacetic acid. Rosina Matarese Palmieri et al. (2005) reported simultaneous determination of Cd (II), Cu (II), Pb (II) and Zn (II) by derivative stripping chronopotentiometry in *Pittosporum tobira* leaves: a measurement of local atmospheric pollution in Messina (Sicily, Italy).

In 1996, C. Erbar and P. Leins show that in *Pittosporum tobira* all floral organs are initiated in a strictly acropetal succession. It is striking that sepals and petals show an extremely early hyponastical development.

G. Lorenzini et al. (2006) concludes that leaves of *Pittosporum tobira* are indicators of airborne trace element and PM10 distribution in central Italy. Michal Oren-Shamir et al. (2001) establish that the coloured shade of branches nets can improve the yield and quality of green decorative branches of *Pittosporum tobira variegatum*. A dorso-ventral structure and the

lack of sclerenchyma are characteristics of the *Pittosporum* (*Pittosporaceae* / *Araliales*) lamina. The mechanical support is insured by the two epiderma and the collenchyma tissues of the main and secondary veins (Neuner et Bannister, 1995).
The multiseriate epidermis may be found among species of the Pittosporaceae family (Essau, 1965; Evert, 2006); at *Pittosporum undulatum* epiderma was occasionally double under light conditions (Gleadow et al., 1983).
The development of the palisadic parenchyma is depending also on light conditions, so this tissue can be composed of three or fewer rows of cells (Gleadow et al., 1983).
Schizogenous ducts located in the pericycle are found in the *Pittosporaceae* species (Abbayes et al., 1963; Turner, 1999); their excreta are volatile terpenes (Essau, 1965).
Crystals of calcium oxalate can be found in the cells of the leaves. In variegated leaves, such as those of the *Pittosporum* species, crystals are smaller and less numerous there where the number of chlorophyll granules is reduced (Metcalfe et Chalk, 1981).

MATERIALS AND METHODS

Macroscopic observations. Our research was initiated from rooted cuttings with 3 knots and a root volume of about 1 cm^3 (Figure 1).

Figure 1. Rooted cuttings

They were planted in pots of 10 cm in diameter, in a substrate made of equal parts of garden soil, peat and perlite. We have made three fertilization variants: Variant V 1 – Osmocote (15 N : 9 P : 12 K : 2.5 Mg + microelements) 10 g / 1 kg substrate, incorporated in the substrate before planting the rooted cuttings; variant V 2 - Atonik (0.2% sodium ortho-nitrophenolate, 0.3% sodium paranitrophenolate, 0.1% sodium nitroguaiacolate,) 0.1%, foliar application bi-monthly; Variant V 3 – Amalgerol (essential oils, herbal extracts, seaweed extracts, distilled mineral oil) 0.5%, radicular application bi-monthly.
The observations we made were: the height and diameter of the plants, the number and length of branches, the leaves number per plant.
Being young plants in the first year of its life, we have not yet had blooming plants in experiments.
Microscopic observations. Transverse sections of the *Pittosporum* leaves collected off the middle nodes of the stem were prepared for microscopic observations by classical methods: clarified for 24 hours with chloral hydrate, washed with tap-water and stained with alaun-carmin and green iodine. Observations and measurements were accomplished with the Leica DM 1000LED microscope, provided with LAS-CORE soft; photos were taken with the DFC 295 camcorder.

RESULTS AND DISCUSSIONS

Macroscopic results. Our research demonstrates that the applied fertilization regime strongly influenced the values of growth and development of *Pittosporum tobira* plants (Figure 2).

Figure 2. Plant growth according to the applied fertilization regime

Table 1 shows that the highest plant height values are recorded in plants fertilized with Osmocote (Figures 3). Previous research by ours and other authors of various flower species shows that Osmocote is a particularly balanced fertilizer with a strong positive influence on the values of plant growth and development.

Table 1. The variation of plants height (cm)

Variant of fertilizer	Month			
	IV	VI	VIII	X
Osmocote	6.25	8.70	11.60	15.30
Amalgerol	6.00	8.80	10.80	14.20
Atonik	5.60	7.60	7.90	9.60

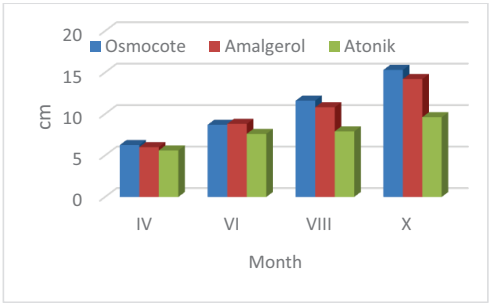

Figure 3. The height plants differences

The plants diameter records the highest values also in plants fertilized with Osmocote, followed by plants fertilized with Amalgerol and those fertilized with Atonik (Table 2, Figures 4, 5, 6).

Table 2. The variation of plants diameter (cm)

Variant of fertilizer	Month			
	IV	VI	VIII	X
Osmocote	5.60	7.80	8.50	10.70
Amalgerol	5.00	6.84	7.20	8.60
Atonik	4.80	6.80	7.10	7.80

Figure 4. Plant fertilized with Osmocote

Figure 5. Plant fertilized with Amalgerol

Figure 6. Plant fertilized with Atonik

The number of ramifications per plant differs very little from one variant to another (Table 3).

Table 3. The variation of branches number

Variant of fertilizer	Month			
	IV	VI	VIII	X
Osmocote	1.84	3.60	3.80	3.90
Amalgerol	1.84	3.10	3.20	3.50
Atonik	1.84	3.00	3.00	3.00

Instead, the length of plant branches is visibly influenced by the fertilizer applied, especially from the second fertilization month (Table 4, Figure 7).

Table 4. The variation of length of branches (cm)

Variant of fertilizer	Month			
	IV	VI	VIII	X
Osmocote	2.94	6.10	8.50	10.30
Amalgerol	3.00	5.60	6.20	7.40
Atonik	2.80	3.90	5.50	6.00

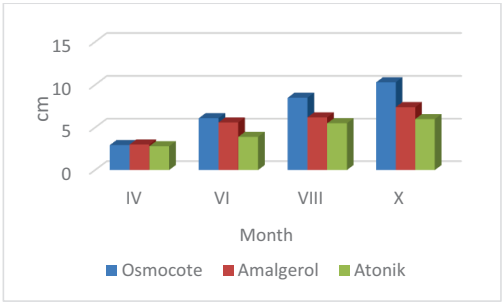

Figure 7. The differences between the length of branches

Also, the number of leaves per plant is strongly influenced by the applied fertilizer, the highest values of this growth indicator being determined by the Osmocote fertilizer and the lowest of the Atonik fertilizer (Table 5, Figure 8).

Table 5. The variation of leaves number

Variant of fertilizer	Month			
	IV	VI	VIII	X
Osmocote	20.40	52.00	81.00	115.80
Amalgerol	18.50	49.50	43.00	61.70
Atonik	20.30	42.70	43.00	51.00

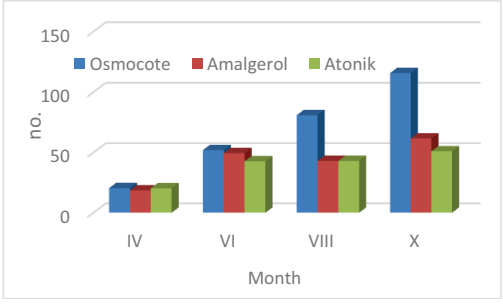

Figure 8. The differences between the leaves number

Microscopic results. ***Plants fertilized with Osmocote***. The average thickness of the cells of upper epidermis was 25.38 µm, and the thickness of the cuticle was 4.26 µm to this variant. Cells with periclinal divisions were more common in upper epidermis (Figure 9).
The mesophyll thickness is 184.04 µm on average. There is a single row with cells lacking in chlorophyll granules of the three layers of the palisade parenchyma (Figure 10).

Figure 9. Periclinal division to the cells of upper epidermis (Osmocote variant)

Figure 10. Palisade parenchyma (pp) (Osmocote variant)

Secondary veins are attended by secretory ducts; crystals of calcium oxalate can be observed in the mesophyll cells (Figure 11).

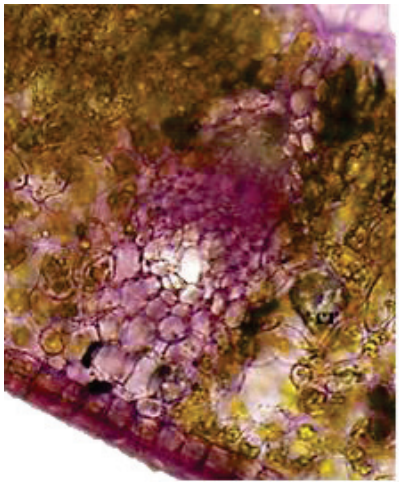

Figure 11. Secondary vein and secretoy canal (Osmocote variant); cr – crystals of calcium oxalate

In the main vein secretory canals are present outside of the phloem area (Figure 12).

Figure 12. Secretory canals in the main vein (Osmocote variant)

The mean thickness of the cells of lower epidermal was 11.13 μm and the thickness of the cuticle was 4.46 μm on average.

Plants fertilized with Amalgerol. In the single-layered upper epidermis can be observed individual cells with periclinal divisions (Figure 13). The average of the epidermal cells thickness is 25.56 μm and the cuticle thickness is 4.3 μm.

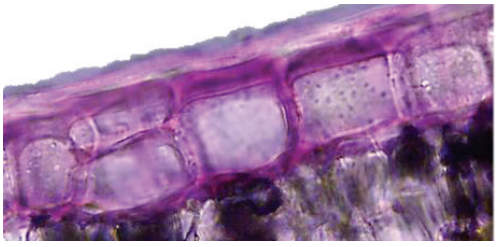

Figure 13. Upper epidermis (Amalgerol variant); cells with periclinal divisions

The first two rows from the three-layered palisadic parenchyma consist of cells lacking chlorophyll granules (variegated leaf) (Figure 14).

The average of the mesophyll thickness is 179.75 μm.

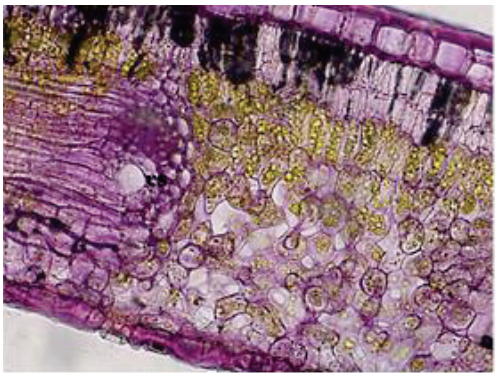

Figure 14. Mesophyll (Amalgerol variant); cs – secretory canal

Schizogenous ducts can be observed in the main and secondary veins, near the phloem area (Figure 14, 15).

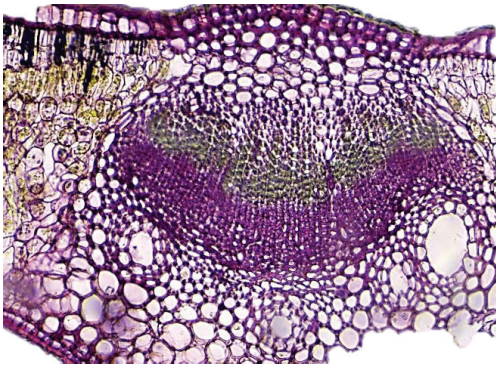

Figure 15. Secretory canals in the main vein (Amalgerol variant)

The lower epidermis consists of a single layer of cells, with 13.10 μm in thickness, covered by a cuticle of 4.3 μm height.

Plants fertilized with Atonik. The single-layer upper epidermis of 25.6 μm thick is covered with a 5.07 μm cuticle. As in the case of the Amalgerol variant periclinal divided cells can be seen among the rest of the epidermal cells (Figure 16).

The leaf mesophyll, differentiated into palisadic and spongy parenchyma, is of 166.81 μm thick.

A reduced number of chlorophyll granules are observed in the first two cell rows of a three-layered palisadic parenchyma. Secretory canals can be observed in the main vein also in the secondary veins (Figure 17, 18).

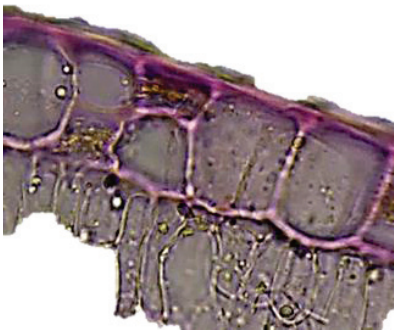

Figure 16. Periclinal division to the cells of upper epidermis (Atonik variant)

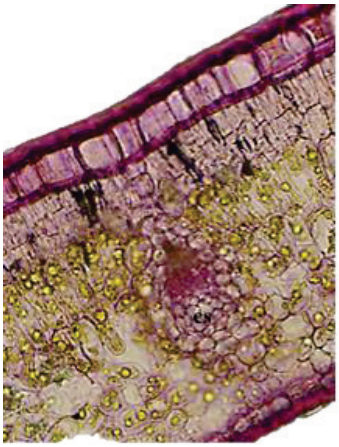

Figure 17. Transverse section of lamina prin (Atonik variant); cs – secretory canal

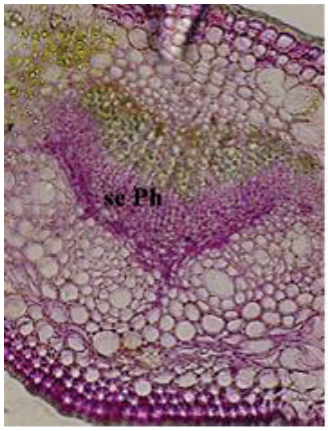

Figure 18. Secretory canals in the main vein (Atonik variant); scPh – secondary phloem

The average thickness of the cells of lower epidermis is 13.80 µm, and the cuticle is 4.19 µm thick (Figure 19). The main value of the foliar components to the three variants of fertilizations in Pittosporum can be observed in Table 6.

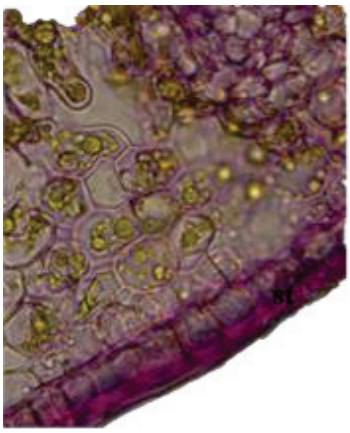

Figure 19. Lower epidermis (Atonik variant); st – stomata

Table 1. Mean values of the foliar layers to the three variants of fertilizations in *Pittosporum*

Variant	Upper epidermis thickness (µm)		Mesophyl (µm)	Lower epidermis thickness (µm)	
	Cells	Cuticle		Cells	Cuticle
Osmocote	25,38	4,26	184,04	11,13	4,46
Amalgerol	25,56	4,30	179,75	13,10	4,3
Atonik	25,46	5,07	166,81	13,80	4,19

CONCLUSIONS

The Osmocote fertilizer is strongly influenced all the elements of plant growing and development. This has led to great increases in the quantitative aspects of plant organs (the height and diameter of plants, the number and length of plant branches, the total number of leaves). After Osmocote, the fertilizer Amalgerol influenced the strongest growth of plants, followed by the Atonik fertilizer. In the first two months of fertilization, differences between variants are small, but they are progressively accentuated in the last months of observations on plants.

This confirms and strengthens the importance of the fertilization regime on the growth and evolution of plants and demonstrates the effectiveness of the fertilizers used.

Comparing the data of the foliar component measurements for the three variants it can be observed that the type of fertilization does not affect the thickness of the cells of the upper

epidermis, their medium values were much the same. The influences can be observed to cuticle layer thickness, this being obviously bigger in the case of the Atonik variant.

The Osmocote variant of fertilization ensures the formation of a developed parenchyma at the mesophyll level, the lowest value being in the case of Atonik variant.

The thickness of the lower epidermis was much almost the same for the Amalgerol and Atonik variants, while for the Osmocote variant was smaller, but in this case the cuticle layer was thicker.

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