PROPERTIES OF *SEDUM* SPECIES APPRECIATED FOR VEGETATED ROOFTOP SYSTEMS – A REVIEW

Zaharia A., Denisa Andreea Jucan (Horţ)*, Erzsebet Buta, Ioana Conţiu, Ancuţa Maria Ivan

Deparment of Ornamental plants. University of Agricultural Sciences and Veterinary Medicine, 3-5 Mănăştur Street, Cluj-Napoca, Romania;

**Corresponding author: denisa.jucan@usamvcluj.ro*

Abstract. There are many reaseons for which sedums are used in green roofs arrangements. Theyr ability to adapt to different ecological conditions, low maintenance, their capacity of purifying the air and the soil are some of the results obtained so far by researchers. Each species has its qualities and it must establish the final scope of arrangement to use appropriate plants.

Keywords: biodiversity, green roof, microclimate, water flow

INTRODUCTION

The installation of vegetative rooftop systems seems to exist from the earliest times when, in areas where there was no wood, humans used clay and sod as building materials (Monterusso et al., 2005). Even green roofs are carefully engineered to function as high-performance infrastructural elements, they are living systems, so they grow and change over time. They become mature, die, and regenerate as the roof is exposed to disturbances because of the environmental conditions. Solar radiation is rarely evenly distributed, climate changes every year, growing media and roof drainage are modifying overtime. Extensive roofs have a thin layer of soil and can be grown sedums designed to be self-sustaining and require minimum maintenance (Molineux et al., 2009). Sedums were recommended because they easily adapt to the environmental conditions on rooftops (Berghage et al. 2007). The performances of *Sedums* were tested in different ecological conditions, experiences were made on every continent with very diverse purposes (Al-Busaidi et al., 2013).

Aims and objectives. The purpose of this paperwork is to present the reasons why *Sedum* species can be recommanded in green roofs designs and to promote new species that have proven to be as precious as the most common species of the genus, in these kind of arrangements.

RESULTS AND DISCUSSION

Researchers have proved that Sedum plants can influence the biodiversity, the waterflow circuit, the regulation of temperature, humidity, generaly, the microclimate of the builging's rooftop. Green roofs have significant benefits in creating new habitats for birds and insects (Al-Busaidi et al., 2013), energy conservation by reducing insolation (Wong et al., 2003), improve the microclimate by evapotranspiration and reduce roof temperatures (Kohler et al., 2002). In the Mediterranean climatic conditions the green roof is able to reduce the cooling load by 11% for thermostatically controlled buildings (Sfakianaki et al. 2009).

Castleton et al., 2010 concluded that old buildings with poor insulation received the largest benefit from a green roof. The *Sedum* species are able to easily adapt to dry areas because of their low level of transpiration during the day, thus reducing the amount of water

lost. Green roof with sedums has a higher runoff coefficient than those with more developed vegetation. To prove the results, researchers used as vegetal material sedums like: *S.album, S. sexagularer, S. reflexum, S. kamchatikum, S. spurim, S. acre S. aizoon, S. kamtschatikum 'Weihenstephaner Gold', S. mexicanum, S. nussbaumerianum, S. xrubrotinctum, S. sarmentosum, S. sieboldii, S. spectabile, S. spurium* 'Purpurteppich' (Gromaire et al., 2013; Tan and Sia, 2005). Research on reducing the pollution using plants was approached on all continents, from Europe to various research centers in the USA and Asia, and especially in China and Japan, where air quality is poor. In the category of succulents was identified *Sedum album*, whose absorption properties of PM10 suspended particles in the atmosphere have been proven by Speak et al. in 2012. *Sedum album* has the capacity to absorb 0.42 g/m2 per year of PM10 (Speak et al., 2012), *Sedum alfredii* is a lead hiper-acumulator (Lu and Zhang, 2014), while *Sedum spectabile* Boreau species can rarely transport Cr from root to the aboveground organs, but, Cd, Hg and Co could be easily transported (Wang et al., 2008).

Plants with good results in the phytoremediation process must also fulfil a other tasks to be suitable in landscaping green roofs, such as: tolerance for all substances at the site; a high growth rate and a developed biomass without exceeding the specific dimensions of a green roof set-up in an intensive or extensive system; tolerance to prolonged drought, increased heatstroke and high temperature, tolerance to pH changes and optimal development on thin substrate (Sarma, 2011).

CONCLUSION

The acclimatization of newly introduced taxons of Sedum in culture and their promotion for green roof designs in Romania, can increase the diversity of plants suitable for this category of landscape.

REFERENCES

1. Al-Busaidi A, Yamamoto T, Tanak S and Moritani S (2013). Evapotranspiration - An Overview Chapter: Evapotranspiration of suculent plant (Sedum aizoon var. floribundum), Publisher InTech, editet by Stavros Alexandris.

2. Berghage R, Jarrett A, Beattie D, Kelley K, Husain S, Rezai F, Long B, Negassi A, Cameron R (2007). Quantifying evaporation and transpirational water losses from green roofs and green roof media capacity for neutralizing acid rain. Report, National Decentralized Water Resources (NDWRCP) Research Project 2007. Pennsylvania State University.

3. Castleton HF, Stovin V, Beck SBM, Davison JB (2010). Green roofs; building energy savings and the potential for retrofit. Energy and Buildings 42: 1582-91.

4. Gromaire MC, Ramier D, Seidl M, Berthier E, Saad M, de Gouvello B (2013). Impact of extensive green roofs on the quantity and the quality of runoff – first results of a test bench in the Paris region, NOVATECH 2013, B4 - TOITURES VÉGÉTALISÉES / GREEN ROOFS: 1-10.

5. Kohler M, Schmidt M, Grimme FW, Laar M, de Assunção V, Paiva L, Tavares S (2002). Green roofs in temperate climates and in the hot-humid Tropics- far beyond the aestetics. Environ. Management and health 13: 382-391.

6. Mang L, Zhang Z (2014). Phytoremediation of soil co-contaminated with heavy metals and deca-BDE by co-planting of Sedum alfredii with tall fescue associated with Bacillus cereus JP12, Plant soil, 382: 89-102.

7. Molineux CJ, Fentiman CH, and Gange AC (2009). Characterising alternative recycled waste materials for use as green roof growing media in the U.K. Ecological Engineering 35(10): 1507-1513.

8. Monterusso MA, Rowe DB and Rugh CL (2005). Establishment and persistance of

Sedum spp. and native taxa for green roof applications, HortScience 40(2): 391-396.

9. Sarma H (2011). Metal Hyperaccumulation in Plants: A Review Focusing on Phytoremediation Technology, Journal of Environmental Science and Technology, 4: 118-138.

10. Sfakianaki A, Pagalou E, Pavlou K, Santamouris M, Assimakopoulos MN (2009). Theoretical and experimental analysis of the thermal behaviour of a green roof system installed in two residential buildings in Athens, Greece. International Journal of Energy Research 33:1059-1069.

11. Speak AF, Rothwell JJ, Lindley SJ, Smith CL (2012). Urban particulate pollution reduction by four species of green roof vegetation in a UK city. Atmospheric Environment 61: 283-293.

12. Puay Y T and Sia A (2005). A pilot green roof research project in Singapore, in Greening Rooftops for Sustainable Communities Conference. Washington DC, USA.

13. Wong NH., Cheong DKW, Yang H, Soh J, Ong CL, Sia A (2003). The effect of roof top garden on energy consumption of a commercial building in Singapore. Energy build 35: 353-364.

14. Wang Y, Dai BQ, Xin SG, Kang YH, Li N (2008). Physiological responses and absorption of heavy metals by Sedum spectabile under the stress of combined heavy metal pollution, Journal of Agro-Environment Science. 27:1051-1056.

15. Tan P.Y and Angelia Sia, 2005, A pilot green roof research project in Singapore, Greening Rooftops for Sustainable Communities Conference, Washington DC, USA, 4-6 May 2005.