Bayerische Landesanstalt für
Weinbau und Gartenbau

Do urban trees planted in soil substrates need to be fertilized?

First results from the project 'Urban Green 2021' in Bavaria, Germany

Stadtgrün 2021

Introduction

Standardized soil substrates for urban tree pits are defined by physical, but not by chemical characteristics, i.e. by a defined grain size distribution of the substrate (Fig. 1). Therefore, standardized substrates can differ considerably in their chemical composition and available plant nutrient contents.

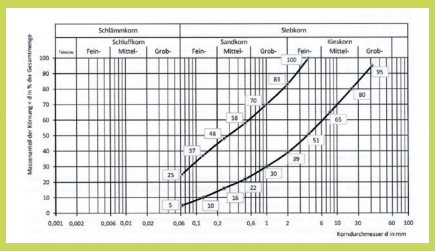

Fig. 1: Grain size distribution curve for open tree pits according to the guideline of the Research Society for Landscape Developing Landscape Construction (FLL)

Fig. 2: Installation of the FLL-substrate for open tree pits

Urban tree project: "Urban Green 2021"

In this project, standardized soil substrates were assembled according to the given grain size distribution for open tree pits in three different Bavarian cities. According to the use of different local inorganic and organic components the nutrient availability of the substrates differed especially between Würzburg (volcanic source material/minerals) and the other cities (tab. 1).

tab. 1: Analyses of the available plant nutrients in the substrates of the different cities

	pH	P_2O_5 (CAL) mg/100g soil (dry weight)	K_2O (CAL)	Mg ($CaCl_2$)	C_{org} %	organic matter %	NH_4-N g/100g soil (wet weight)	NO_3-N g/100g soil (wet weight)
2009/2010 before planting								
Würzburg	7,4	12	80	14	0,56	1,0	0,38	1,16
Kempten	7,4	21	13	11	1,13	1,9	0,07	0,63
Hof/Münchberg	7,3	36	59	14	1,42	2,4	2,14	0,86
spring 2012								
Würzburg	7,3	13	75	13	0,8	1,31	0,06	0,05
Kempten	7,4	25	6	7	1,0	1,67	0,07	0,04
Hof/Münchberg	7,3	39	11	5	1,1	1,93	0,11	0,07
fall 2013 after fertilization in spring								
Würzburg	7,0	14	71	15	1,0	1,66	0,11	0,12
Kempten	7,3	13	7	7	1,1	1,85	0,05	0,12
Hof/Münchberg	7,1	31	10	5	1,0	1,79	0,10	0,26

tab. 2: Cation exchange capacity of the different substrates

2013	Mg	Ca	K	Na	total
Würzburg	16,1	69,3	14,2	5,6	105,3
Kempten	6,6	75,0	1,8	3,0	86,5
Hof/Münchberg	4,4	64,6	2,4	4,0	75,4

tab. 3: Spring 2013: Fertilizer nutrient contents

	Kempten, Hof/ Münchberg	Würzburg
N - P - K (%)	6 - 5 - 11	6 - 5
magnesia (%)	1	1
boron (%)	0,02	0,02
copper (%)	0,03	0,03
iron (%)	0,05	0,05
manganese (%)	0,02	0,02
zinc (%)	0,009	0,009

Due to the low amount of organic matter and clay minerals in soil substrates the cation exchange capacity of these substrates is also very low for the essential plant nutrients (tab. 2). According to the nutrient content classification of the Association of German Agricultural Analytic and Research Institutes, except for phosphorus all nutrients seemed to be low in the second year after planting at two of the three sites. However, these standard values refer to crop plants; unfortunately, no data on nutrient needs of urban trees are available. In Hof/ Münchberg and Kempten, a water soluble NPK fertilizer was applied along with 200 L H_2O/ tree at budburst, while in Würzburg, where the available potassium in the substrate is remarkably high, a special N-P fertilizer was deployed (tab. 3).

Fig. 3: FLL-substrate for open tree pits

Fig. 4: Outrooting in the FLL-substrate after 6 months

Status quo and outlook:

As the N-values of the substrates were still rather low after the first fertilization, a second fertilization was applied in May 2014. This time, only N was applied as a long-term fertilizer in terms of 750 g horn meal (=90g N)/ tree flushed with 200 L H_2O/ tree. Leaf analyses of fertilized and unfertilized trees in July 2014 will show if non-fertilized trees are undernourished, and if so, if the N-fertilization led to satisfactory results.
This and further future analyses of the substrates and leaf nutrient status will help to clarify the following questions:

- do urban trees planted in poor soil substrates need to be fertilized?
- if so, how often should they get fertilized?
- what kind of fertilizers are needed depending on the local composition of the soil substrate?

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