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Polluted urban soil damages lime trees

The impact of polluted urban soil on trees is highlighted in a recent study from Latvia. The researchers found that high salt levels from de-icing chemicals and nutrient imbalance in soil damaged lime trees growing in the city of Riga.

Trees planted in cities are an important part of the urban landscape, providing a range of benefits, from enhancing biodiversity to promoting a feeling of wellbeing. However, the city environment, including problems such as air pollution and soil compaction, does not provide ideal conditions for trees.

This study analysed the chemical composition of soil and how the nutrients available for uptake by plants affected the health of lime trees (*Tilia x vulgaris* H.) growing in Riga, Latvia from 2005 to 2007. Lime trees are one of the most common tree species planted in central, northern and eastern European cities.

The researchers collected soil samples from around 26 trees growing in eight street sections in five streets in central Riga to test for concentrations of 17 nutrients and heavy metals via hydrochloric acid extraction. The trees were chosen to represent a range of health conditions, from 'healthy' to 'severely damaged'. Soil conditions and the health of trees growing in a central park in Riga were compared with street soil samples and trees. Tree health was assessed visually at the end of summer.

In general, the soil analysis revealed a wide range in the concentration of elements available in the different soil samples. In particular, high concentrations of sodium and chloride ions were found in soil collected near the road and were around about 24 and 22 times greater, respectively, than found in the central park soil. These high concentrations are a result of chemicals, typically salt (sodium chloride), used to de-ice roads and pavements during winter. In spring, snowmelt washes the salt into roadside soils.

In addition, soil concentrations of the metals copper and iron were about two to four times higher in streets with heavy trolley bus and tram traffic compared with park soil. These heavy metals are released in tiny fragments by electric transport wires and rails, when the buses and trams are running.

Increased concentrations of calcium and magnesium were also found, probably a result of contamination from building materials, such as bricks and concrete. Soil reaction is altered by higher concentrations of calcium and magnesium. The concentration of elements found in the soil corresponded with the health of the lime trees. Soils around the most damaged trees typically contained higher levels of sodium, chloride ions, magnesium, lower concentrations of several nutrients, including potassium and boron, as well as unfavourable ratios of element concentrations and elevated soil reaction (neutral to slightly alkaline). In general, the healthiest trees were furthest from the edge of the road (over 3.5 metres away), and in the park, where potassium concentrations were the highest.

In addition to the actual concentration of elements, the ratio of certain elements can affect the availability of nutrients for plant development. In most street sites studied, the concentration of potassium was four times lower than the concentration of sodium (which was raised from the use of de-icing chemicals), thus disrupting potassium uptake by the trees. Other imbalances resulted from low calcium or magnesium to sodium ratios.

The researchers recommend fertilising the lime trees with potassium fertilisers if potassium soil concentrations are low, especially during the beginning of the growing season in spring.