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Accumulation of Trace Metals in Leaf Vegetables Cultivated in High Traffic Areas in Ghent, Belgium

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Abstract : Among the challenges associated with increased urban food production are health risks from food contamination, due to the higher pollution loads in urban areas, compared to rural sites. Therefore, the risks posed by industrial or traffic pollution of locally grown food, was defined as one of five high-priority issues of urban agriculture requiring further investigation. The impact of air pollution on urban horticulture is the subject of this study. More particular, this study focuses on the atmospheric deposition of trace metals on leaf vegetables cultivated in the city of Ghent, Belgium. Ghent is a particularly interesting study site as it actively promotes urban agriculture. Plants accumulate heavy metals by absorption from contaminated soils and through deposition on parts exposed to polluted air. Accumulation of trace metals in vegetation grown near roads has been shown to be significantly higher than those grown in rural areas due to traffic-related contaminants in the air. Studies of vegetables demonstrated, that the uptake and accumulation of trace metals differed among crop type, species, and among plant parts. Studies on vegetables and fruit trees in Berlin, Germany, revealed significant differences in trace metal concentrations depending on local traffic, crop species, planting style and parameters related to barriers between sampling site and neighboring roads. This study aims to supplement this scarce research on heavy metal accumulation in urban horticulture. Samples from leaf vegetables were collected from different sites, including allotment gardens, in Ghent. Trace metal contents on these leaf vegetables were analyzed by ICP-MS (inductively coupled plasma mass spectrometry). In addition, precipitation on each sampling site was collected by NILU-type bulk collectors and similarly analyzed for trace metals. On one sampling site, different parameters which might influence trace metal content in leaf vegetables were analyzed in detail. These parameters are distance of planting site to the nearest road, barriers between planting site and nearest road, and type of leaf vegetable. For comparison, a rural site, located farther from city traffic and industrial pollution, was included in this study. Preliminary results show that there is a high correlation between trace metal content in the atmospheric deposition and trace metal content in leaf vegetables. Moreover, a significant higher Pb, Cu and Fe concentration was found on spinach collected from Ghent, compared to spinach collected from a rural site. The distance of planting site to the nearest road significantly affected the accumulation of Pb, Cu, Mo and Fe on spinach. Concentrations of those elements on spinach increased with decreasing distance between planting site and the nearest road. Preliminary results did not show a significant effect of barriers between planting site and the nearest road on accumulation of trace metals on leaf vegetables. The overall goal of this study is to complete and refine existing guidelines for urban gardening to exclude potential health risks from food contamination. Accordingly, this information can help city governments and civil society in the professionalization and sustainable development of urban agriculture.

Keywords : atmospheric deposition, leaf vegetables, trace metals, traffic pollution, urban agriculture
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