Fact Sheet – Urban Contamination and Fruit Trees

This fact sheet aims to address the considerable demand from community groups and landowners for information on the impact of urban contamination on fruit growing in London and is informed by an extensive literature review of academic studies and research.

More and more people in urban areas are returning to the soil to grow their own fresh, seasonal food. However, linked to this revival in urban gardening is a concern about the health impacts of eating fruit and vegetables grown in polluted environments. There are many publications and studies that address the health risks of city-grown vegetables but limited information exists for tree fruit such as apples, pears and stone fruit.

It is sensible to take a precautionary approach regarding soil contamination but we also want to emphasise the many benefits of growing community orchards in urban areas, such as improvements in individual and community health and increased biodiversity. As shown below, the risk from orchard fruit grown in an urban environment is minimal and there is insufficient evidence of adverse health effects from such produce to warrant substantial concern.

This fact sheet aims to provide a useful guide to determining the risks of contamination in an orchard site and measures to address the presence of any harmful chemicals. To prepare this guide, The Orchard Project conducted an extensive scientific literature review and sought advice from a range of sources including the Department for Environment, Food and Rural Affairs (DEFRA); the Soil Association, University of Nottingham; Food and Environmental Research Agency.

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Summary points:

- Do a site assessment of your proposed orchard location – does the history of the site suggest likely contamination?
- If there is reason for concern, consider other locations or look at options for soil testing.
- Site your orchard away from busy roads or railways if possible.
- Reduce contact with bare soil and dust by mulching or planting groundcover plants.
- Monitor children around the orchard and minimise contact with contaminated soil.
- Always wash fruit before eating.

1. The common causes of urban contamination

Commonly found contaminants in urban areas include cadmium, mercury, arsenic, zinc and lead. The presence of these elements is generally related to a history of industrial activity, heavy traffic, historical use of agricultural pesticides or other chemical applications such as lead-based paint on buildings.

The risk to human health from soil contamination is determined by the Environment Agency to be caused by three main factors: ingestion through the mouth (of contaminated soil particles or garden produce), absorption through the skin (from contact with soil) and inhalation through the mouth and nose (of dust and vapour).

Contamination can come from contact with polluted soil, rain splash-back from soil to plant, air-borne dust particles or through absorption through plant roots and transfer to edible parts (leaves, tubers, fruit). Studies have shown that where fruit trees are grown on contaminated soils there is generally limited chemical contamination of the fruit, as plants tend to accumulate these elements primarily in their leaves and roots. Hanging fruit has minimal soil contact and airborne contamination also presents a limited risk with tree fruit, particularly when washed before eating.

2. How to evaluate your site for potential contamination

It is good practice when planning a community orchard to carry out an assessment of the local site conditions, including looking at risk of contamination. The following strategies will help determine potential risk.

Land use history – look at local history resources for maps or documents showing previous land use (try your local library). Talk to local people who have lived in the area a long time. Search online for records. You should consider the potential for contamination if your orchard site is:

- near to old buildings where lead paint may have been used
- within 30 meters of major, busy roads, especially where there are no buildings or vegetation barriers in-between
- in the vicinity of existing or former heavy industrial sites, such as power plants or smelters
- close to a railway or canal especially where there are no buildings or barriers in-between
- in an area previously occupied by orchards (up to the 1950s orchards were commonly sprayed with pesticides containing lead, copper and arsenic).

Visual assessment – look for evidence of landfill sites, old building foundations, and obvious pollution.

Contact your local council – contaminated land is usually the responsibility of the Environmental Health or Planning departments and they will have access to records of previous pollution incidents or sites identified as contaminated.

The Food Standards Agency advised us that as long as a Local Authority or Council hasn't placed a site in its Contaminated Land Strategy, and the land is deemed safe to work on, "generally we would expect uptake of most contaminants to be low to insignificant". 1

Contact the Environment Agency– Contact the EA's Customer Services department and include a grid reference for your site (use this website to find your site's grid reference http://gridreferencefinder.com/), they will let you know of any records of pollution incidents at or nearby to your site. The requests should be made to your local EA area office, which can be found on this website - http://www.environment-agency.gov.uk/contactus/36341.aspx.

Soil testing – if your site assessment suggests likely presence of contaminants you may need to carry out soil tests to determine the level of risk. If you have identified the presence on your site of harmful chemicals, the Environment Agency's Soil Guideline Values (SGVs) can be used to determine whether the levels of dangerous metals in the soil require further investigation and remediation or whether no further action is needed.

Testing can be an expensive process, so it is worth contacting your local council to see if they have already carried out tests in the area or whether they are prepared to bear the costs. Another way to reduce costs is to approach local universities or colleges that have soil-testing laboratories and may be interested in using your site for a student research project. The costs involved at this stage reinforce the need for good site selection and analysis in the planning phase.

3. How to improve your soil and remediate any contaminant problems

You can reduce the risks from contamination through a combination of appropriate site selection, horticultural practices including soil amendments and good food hygiene. If you are unsure of the safety of a site or have had advice against planting, look for an alternative location for your orchard.

Site your orchard away from busy roads, canals and railways or try to ensure there is a protective barrier (e.g. buildings, walls, vegetation) between the site and source of pollution.

Mulch bare soil while the trees are young to reduce dust exposure. This will also help maintain a healthy orchard ecosystem by retaining moisture and adding nutrients to the soil. Avoid using leaf litter collected along busy roads for mulching as you may be importing unwanted contaminants.

[1] Email to The Orchard Project from Dr David Mortimer, Policy Lead, Environmental Contaminants in Food 1/07/2013.

Plant understory and ground cover plants around older trees to reduce dust exposure.

In the case of heavily polluted soils, you may have to remove the contaminated material and replace it with a safe alternative. This is likely to be a prohibitively expensive option for most community orchards and should therefore be considered as a last resort.

Raising pH levels in the soil can help to immobilise metals and prevent uptake by plants. Biochar is a charcoal product for application to soils which has been shown to have a liming effect – in other words when added to the soil it will raise pH levels. Evidence for the environmental benefits of Biochar is increasing and 'The Big Biochar Experiment' offers free samples to groups willing to contribute to ongoing research.

Some sources recommend adding horticultural lime to the soil to raise the pH levels, however lime is a non-renewable resource that must be annually applied to the soil to continue its effect. Organic orchard growers may prefer to avoid the use of horticultural lime.

Some studies recommend adding organic matter (manure, mulch etc.) to the soil to raise pH levels and researchers have had success with this method in several studies. However, the outcome of this treatment depends on the interaction between the organic matter used, the particular soil type and the mix of metals present. In some cases, organic matter can result in lowering the pH levels.

Scientists have identified plants, bacteria and fungi that are useful in bioremediation of contaminated soil and will take up and store contaminants or immobilise them in the soil. However, growth and disposal of these plants can be a technologically and financially intensive process that is unlikely to be within reach of community projects. The long timescales for this remediation approach may also make it unsuitable.

Harvesting fruit grown on contaminated soils – it is recommended that fruit be washed before eating to remove any airborne pollutants. It is especially important to protect young children from the risks of contaminated soils and to ensure they do not eat dirt from the site while unobserved!

Case studies

1. Suspected contamination at Waterlow Park, London

Waterlow Park is a public park in North London. Friends of the Park group were keen to plant an orchard in an area that had grown food many decades ago. The London Borough of Camden was keen to support the orchard, but wanted to ensure there would be no contamination in the fruit. The council perceived a risk because they had tested an allotment site a few metres away from the orchard site and found contamination. The sources of this contamination were cited as being either arsenic used to poison rats in Victorian times or lead paint from a disassembled greenhouse. The London Borough of Camden paid for soil tests on the orchard site after negotiation with the community

orchard group. No dangerous metals were found in the soil, and an orchard of ten trees was planted in February 2013.

This small case study highlights the importance of determining contamination risks on a site-by-site basis. Even though soil contamination was found near to the proposed orchard site, when tested this was found to be very localised. Therefore, where affordable, it is always worth pursuing projects to the soil testing phase if the risk of contaminants being present threatens the project going ahead.

2. Soil versus fruit contaminants at Haggerston Park, London

The Orchard Project planted a small orchard in partnership with Hackney City Farm at Haggerston Park in Hackney, East London. This orchard is in a very urban area, adjacent to a light industrial site and railway sidings and the site is surrounded by mature cherry plum trees (*Prunus cerasifera)*. The soil was tested from 3 pit sites under the mature trees and later the fruit was tested for the same contaminants to see how these compared. Findings from 2010 soil tests showed that the lead and vanadium contamination levels in the soil were above the safe levels recommended for planting in allotments set out by DEFRA's Soil Guideline Value (SGV). This is currently the nearest suitable land-use category, there are no standards for community orchards. Lead levels ranged from 245- 762mg/kg, well above the safe level for lead in allotments of 450mg/kg. Vanadium concentration ranged from 32-48mg/kg, with the safe allotment level standing at 18mg/kg. (All other heavy metals detected were below their respective SGV.)

A follow up test was conducted on samples of cherry plums located next to the soil pit locations in 2012, to determine if there were unsafe concentrations of lead or other heavy metals in the fruit. The findings showed that lead levels in the fruit were <0.06mg/kg and vanadium levels were <0.01mg/kg, so far within the safe levels recommended for growing food on allotment sites as to be negligible. While it is difficult to draw a correlation between the contaminant levels in the soil and levels in the fruit two years later, what this case study does illustrate is that despite high readings of metals in the soil around the trees, the levels present in the fruit were low enough to show there had been limited uptake by the trees. The Orchard Project intends to carry out more tests on other orchard sites around the city to see if the findings from this small survey can be replicated, with more year-to- year measurements.

Conclusion

Urban contamination is an issue that all community orchard groups should address as part of their planning, and the risks should be considered. However, the evidence shows that tree fruit is a low-risk food to grow in urban areas and in addition, orchards deliver significant social, environmental and health benefits.

There is a need for further research in this area and The Orchard Project would welcome any contributions or partners to carry out tests and continue to develop successful remediation strategies.