How to reconcile quality of crops for human consumption and pollutions of anthropogenic soils commonly observed?

Case study inspired by « Synergistic improvement of crop physiological status by combination of cadmium immobilization and micronutrient fertilization.» Wu et al. 2015. Env. Sc. Pollution Research.
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Context

- At the global scale, soil pollutions (induced by industries, transports, intensive agriculture…) particularly by persistent metals are observed.

- The growth of cities in the world is straining urban food systems. Urban agriculture provides fresh food, creates jobs, recycles municipal waste, creates green belts, and strengthens the resilience of cities to climate change. **Pollutions need to be managed!**
It’s obviously preferable to cultivate edible plants on uncontaminated soils!

But [↑ world population + ↓ arable land] ▶ Cultivation of food plants on low/medium polluted soil while reducing phytoavailability of pollutants is a proposed track.

Urban agriculture is booming

(http://ensia.com/; http://www.stockholmresilience.org)
In situ cadmium immobilization technique

Amendment:
- Phosphates; Liming materials;
- Organic matters; Metal oxides

Soil amendment:
Wollastonite (W)

Cd immobilization:
- Adsorption - Complexation
- Precipitation (pH, redox...)
[Speciation change]

↓ Cd bioavailability
Deficiency of immobilization technique

Control plant:
- Low growth rate,
- High Cd uptake
(CK condition)

Objective:
- Higher growth rate,
- Less Cd uptake,
- Stronger photosynthetic ability

with immobilization amendment:
- Less Cd uptake,
- But, chlorotic disorder

Deficiency of immobilization technique
(1) Wollastonite to immobilize Cd.
+ (2) Micronutrient fertilization to favor plant biomass.

Amaranthus tricolor L.

Micronutrient (Zn, Mn),
synchronous immobilization with Cd (by W)

(W+Zn+Mn condition)
Results & Discussion

- Changes of biomass for Amaranthus tricolor L.

The best way is (W+Zn+Mn).

(Wu et al., 2016)
Results & Discussion

- Changes of photosynthetic pigment content
  
  (Wu et al., 2016)
Results & Discussion

- Changes of metal concentrations in plant

(Wu et al., 2016)

Cd concentration (mg/kg)  Zn concentration (mg/kg)  Mn concentration (mg/kg)
Cd phytoavailability permits to cultivate healthy plants:

- Addition of amendments such as wollastonite (W).
- pH increase favors Cd precipitation.
- In addition to Cd immobilization, it’s crucial to improve general soil fertility (organic matters, nutrients…) and favor ecosystem services.
In recent years, **urban agriculture in Lisbon** has become more widespread. Expansion of agriculture within the city and its suburban areas and on the urban poor who grow vegetables in response to the current crisis. **In this way, society has been contributing to the city’s resilience.**

(Urban Agriculture magazine; w3.ruaf.org)
https://villepermaculturelle.wordpress.com/tag/permaculture-urbaine/
For supplementary information

- Wu et al. 2015. Synergistic improvement of crop physiological status by combination of cadmium immobilization and micronutrient fertilization. Env. Sc. Pollution Research.


- http://www.sustainabletable.org/251/innovative-agriculture
