MODELLING WATER AND N IN LISBON URBAN FARMS

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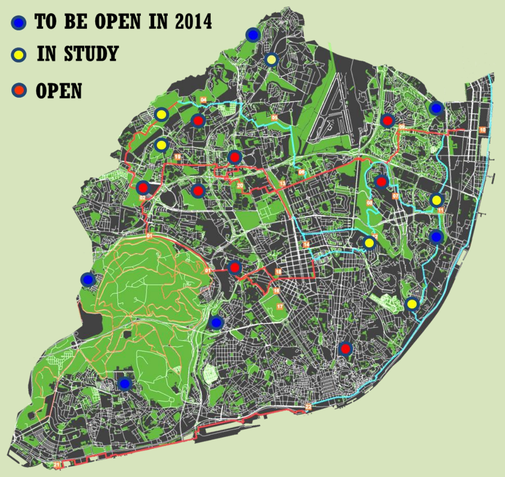
❑ BACKGROUND AND OBJECTIVES

In Lisbon a recent survey identified around 77 ha of cultivated allotments under the municipal regulations (1) where soil fertility is maintained by large amounts of organic fertilizers. The objectives of the study were to characterize the actual agricultural practices related to irrigation and fertilization in case-study urban agriculture allotments (UA) and to propose alternative practices to minimize N losses. The methodology integrates field experiments and modelling. The agricultural system Root Zone Water Quality Model (RZWQM) (2) was used.



Lisbon urban farming plan (3)

❑ MATERIALS AND METHODS

Case studies

In November 2011 a survey was carried out and two study case allotments were chosen:

- Granja Conv (GC): unregulated; mineral fertilizers are complemented by organic amendments;
- Ajuda Org (AO): regulated by the municipality; only organic fertilizers are applied.

Data collection

- Soil samples were collected for the physical properties and OM;
- Soil water contents were determined by the gravimetric method;
- Samples from the irrigation water sources were analyzed for N-NO_3.

Organic materials properties

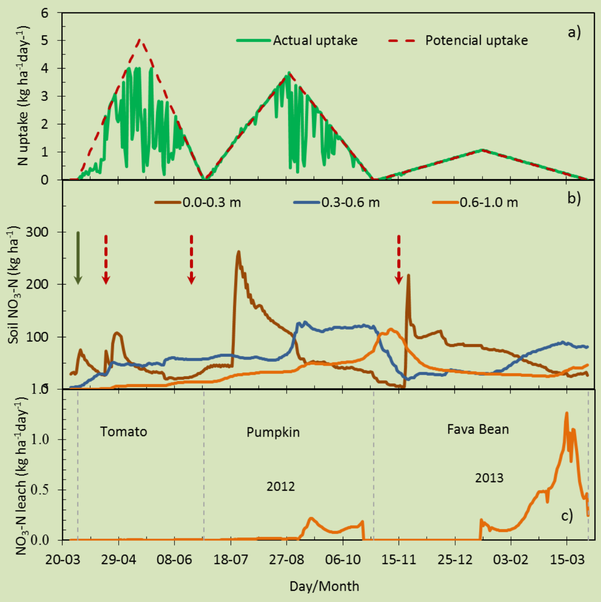
UA	Source	Application rate (mg ha^{-1})	Organic C (mg ha^{-1})	NH_4-N (kg ha^{-1})	C:N
GConv	bio compost (green and food waste) + horse manure	4.5	1.8	90	20.0
AOrg	manure (15% horse, 50% chicken, 30% goat)	11.1	4.5	119	13.2

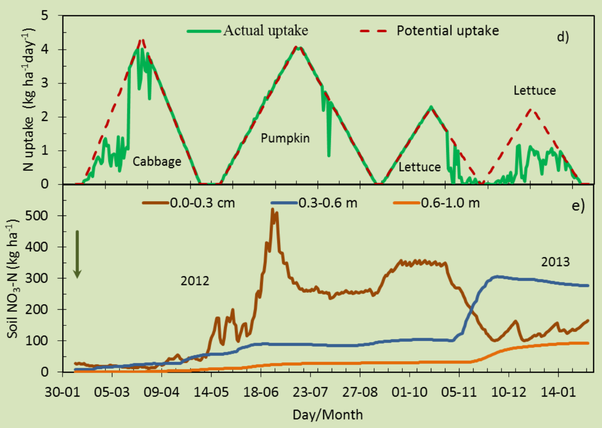
❑ CONCLUSIONS

- The studied urban garden production systems were intensive, continuously cropped using high application rates of N and water;
- N inputs were derived mainly from organic amendments with different sources, composition and N release rates;
- The management factors contributing to appreciable N losses are: (i) irrigation and N managements, based on the allotment user's experience, leading to excessive applications in comparison to crops requirements; (ii) the majority of the organic materials applied revealed inadequate C:N ratios; (iii) non-fertiliser N sources were not considered in the fertilisation planning;
- Modelling allowed a detailed conceptual analysis of water and N balances in each system; the quantification of the N surpluses release rates of each fertilising mixture, and the identification of the major pathways of N losses in association with each agro system characteristics;
- The organic production system *per se* is not necessarily environmentally safer than the conventional production system. The N load associated with the organic amendments can be very high if the C:N is too low as a result of an unbalanced composition of the organic mixture;
- Among reduction techniques for leaching the use of mechanical manometers, of simulation models and the adjustment of the C:N of organic amendments are advised.

❑ RESULTS AND DISCUSSION

▪ *Nitrogen fluxes*





a), b), and c) Granja Conv d), and e) Ajuda Org

↓ Organic application ↓ Mineral application

▪ *Water balance*

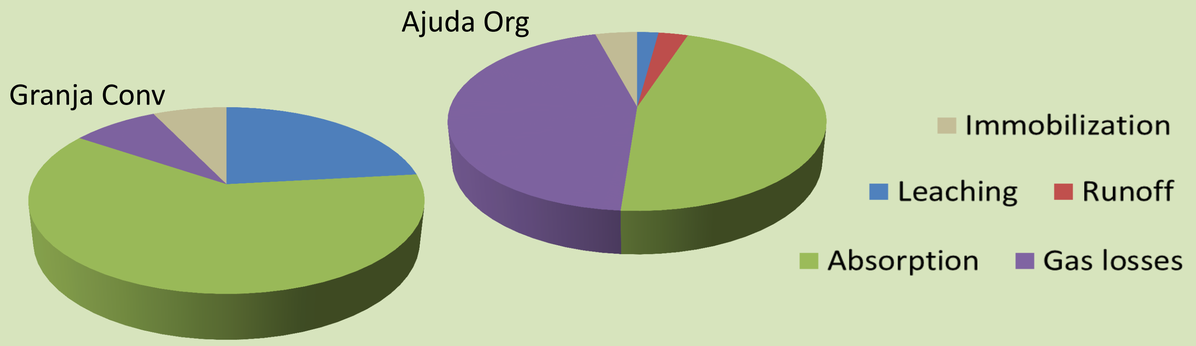
Period (days)	Storage Initial	Storage Final	P	IR	D	RO	ETa
Granja Conv							
360	162	174	347	828	300	0	919
Ajuda Org							
333	182	213	413	595	125	45	849

P - precipitation
IR - irrigation
D - drainage
RO- runoff
ETa – evapotranspiration
all terms in mm

▪ *Non fertilizer N sources*

UA	Non fertiliser N sources (%) SOM	Non fertiliser N sources (%) Irrigation	Organic amendments N release rate (kg N Mg^{-1} year^{-1})
GConv	12	35	9.2 with C:N = 20
AOrg	26	14	20.1 with C:N =13.2

▪ *Pathways of N losses*



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