Agronomic use of compost from decentralised urban composting models in lettuce production: yield and crop development

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Introduction

In recent years, there has been a shift in **municipal organic waste management models** from a linear model based on resource consumption and waste generation to a circular model where **waste** is considered as a **new resource**. This shift, together with new European policies aimed at increasing recycled bio-waste streams, has led to the emergence of **new composting models**. Decentralised urban composting models, as a method of managing separately collected organic waste, allows us to **reduce** environmental **pollution** from unsustainable management, **recovering** essential **nutrients** for crops, and thus **reducing** the consumption of **chemical fertilisers** in agriculture.

In this work, the **composts** obtained from these **new composting models** (community composting and decentralised urban composting) were used for **lettuce** production to demonstrate their ability to **replace inorganic fertilisers** without compromising optimal crop development.

Material & methods

Community Composting
- Fontanars, CC1
- Carrícola, CC2

Decentralized Urban Composting
- Lumbier, DC1
- Sort, DC2

Clay-Loam Soil
Sieving < 5 mm; 1kg

Inorganic Fertilizer
NPK 15-15-15, IN

Lettuce crop
Var. *Little Gem Incitatos*

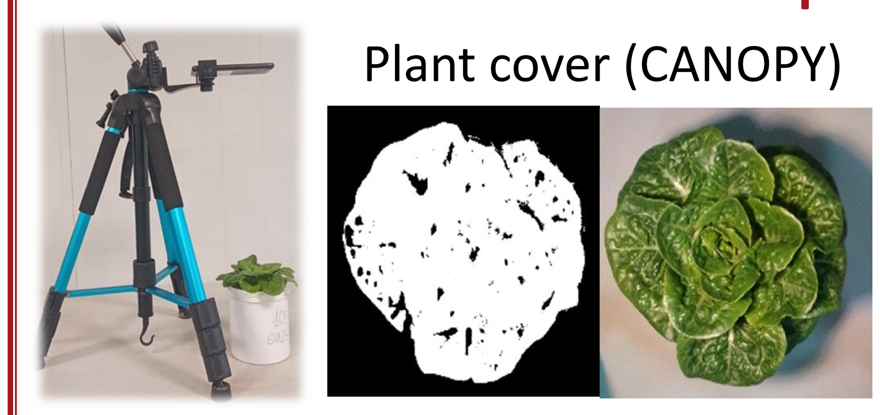
Lettuce dose: 210 kg N ha^{-1} (1L pot)

Growing conditions:

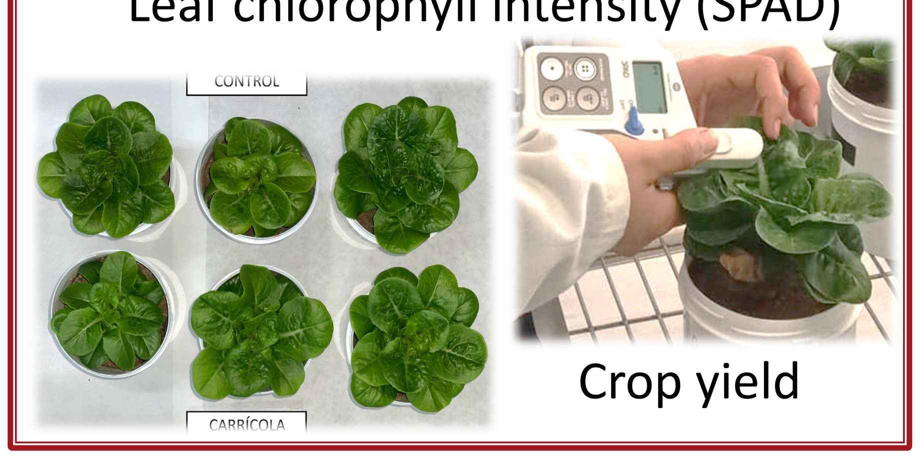
- 50% WRC, Initial watering=140g pot^{-1}
- 21 °C
- Relative humidity = 60%
- 12h of photoperiod
- Treatment in triplicate
- Random arrangement
- Twice a week
- 60 days

Parameters studied in the crop:

Plant cover (CANOPY)



Leaf chlorophyll intensity (SPAD)



Crop yield

Results & Discussion

Agronomic characteristics of the composts used:

Parameters	DC1	DC2	CC1	CC2
pH	7.7	8.1	8.2	8.7
EC (dS m^{-1})	1.1	5.2	3.2	6.1
TOC/TN	13.0	11.1	13.3	12.0
TN (%)	1.9	2.9	1.8	2.1
P_2O_5 (%)	1.5	1.3	2.1	1.7
K_2O (%)	0.9	2.2	1.1	2.5
Na (g kg^{-1})	1.3	5.5	3.3	7.0
Ca (%)	11.3	5.1	15.3	13.7
Mg (%)	0.4	0.3	0.9	1.4
Potentially toxic elements				
Cu (mg kg^{-1})	32.0	39.1	20.8	56.9
Zn (mg kg^{-1})	104	102	66.1	83.7
Cr (mg kg^{-1})	70.7	52.8	22.0	54.2
Cd (mg kg^{-1})	0.3	0.5	0.4	0.3
Pb (mg kg^{-1})	15.1	15.9	9.1	20.6
Ni (mg kg^{-1})	19.4	18.6	7.3	18.2
Maturity and stability parameters				
CEC (mep 100g^{-1} OM)	89.9	99.5	101	102
GI (%)	115	99.1	109	51
Self-heating test (Brinton et al. 1995)	V, Stable	V, Stable	V, Stable	V, Stable

- Alkaline pH
- EC
  - DC1 + CC1 ↓
  - DC2 + CC2 ↑
- Fertilizer capacity
- Madurity and Stability

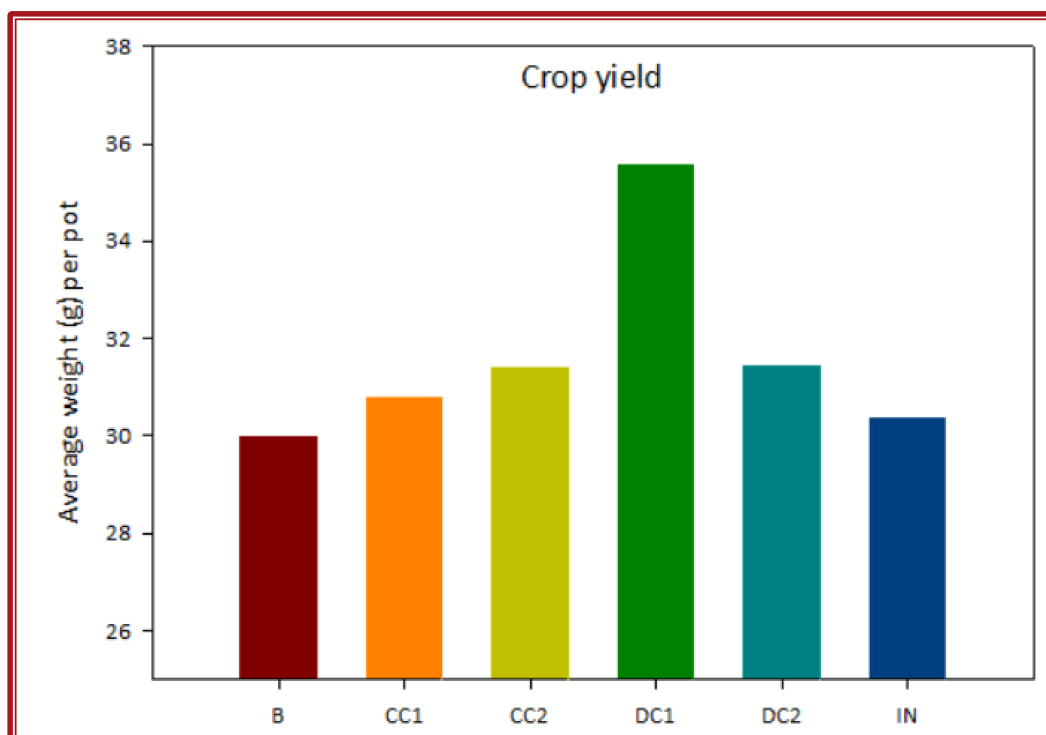
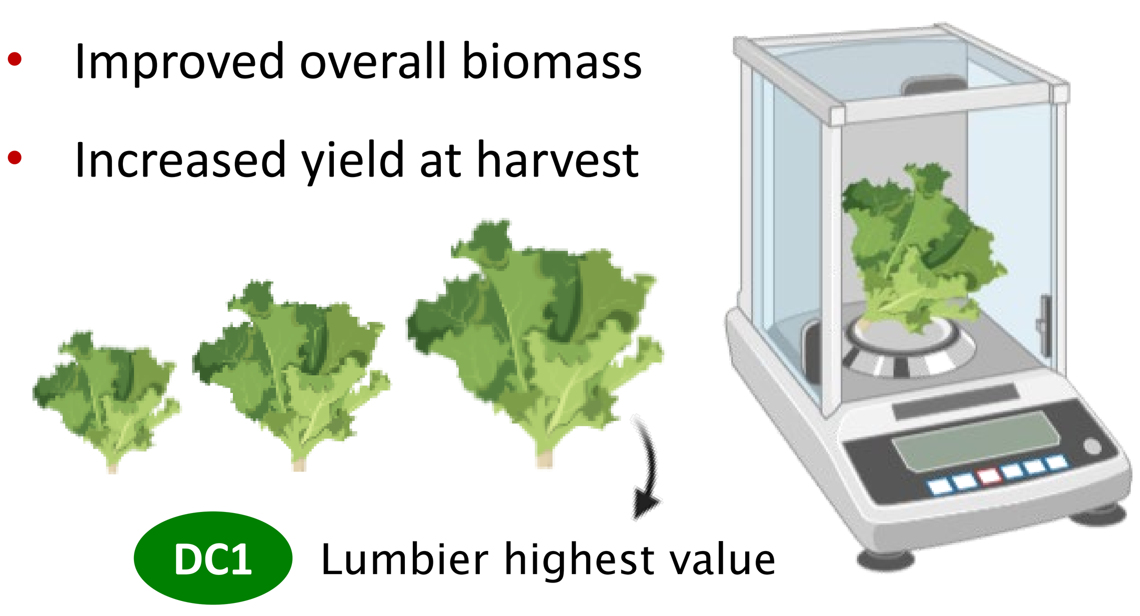


Figure 1 - Average biomass of 3 lettuce per treatment

Crop yield:

The application of compost in lettuce cultivation:
- Improved overall biomass
- Increased yield at harvest



DC1 Lumbier highest value

Parameters indicative of crop development:

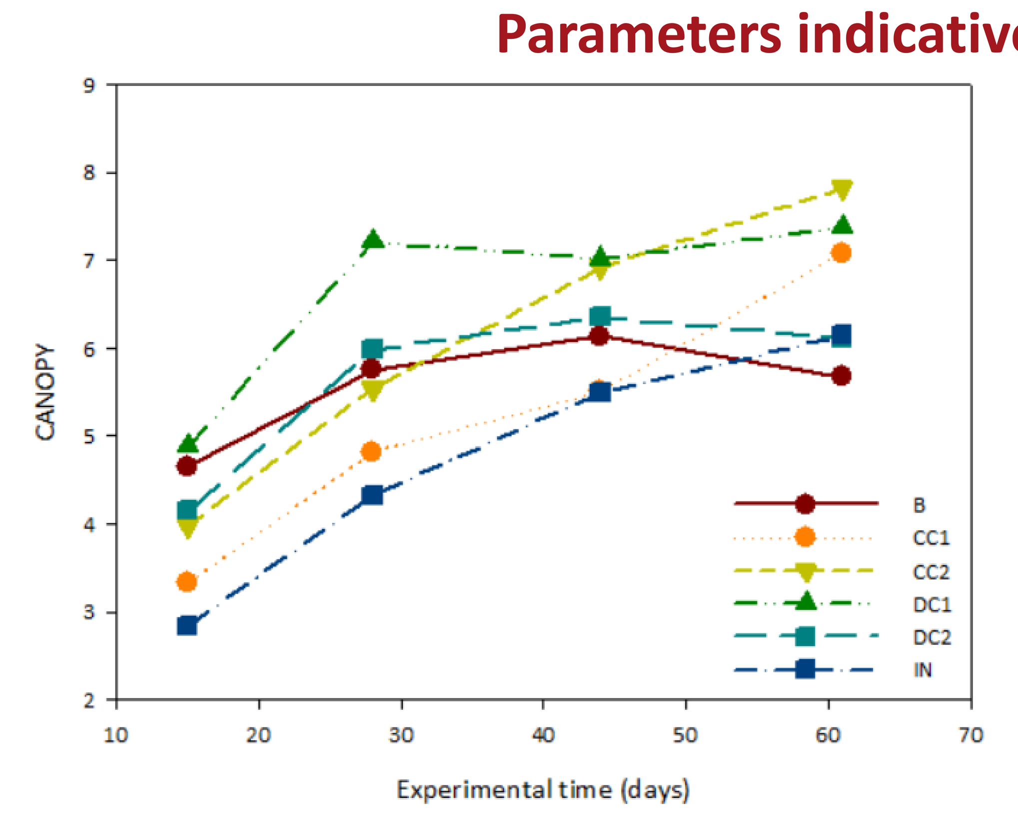


Figure 2 - CANOPY average of 3 lettuce per treatment

- Gradual increase with experimental time
- Beginning of experiment: higher coverage in control and DC2 – Sort
- End of experiment: coverage in treatments > control

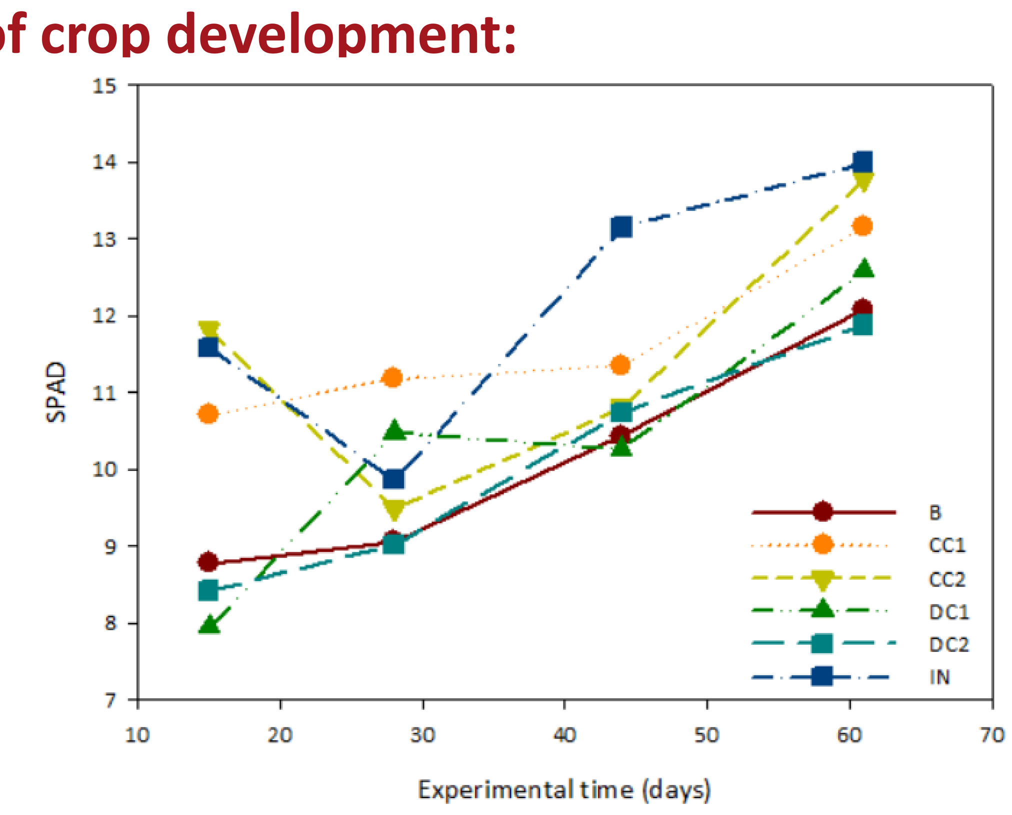


Figure 3 - SPAD average of 3 lettuce per treatment

- Increase over tested time for all treatments
- Final values higher than control

⚠ DC2 Sort < control B

Conclusions & Acknowledgements

The management of bio-waste through **decentralised urban composting** and **community composting** models makes it possible to obtain final composts with **fertilizing capacity** and physico-chemical, chemical and biological characteristics compatible with their **use** in **agriculture**, without causing risks to human health and the environment. The agronomic use of this type of compost is presented not only as a **sustainable management** method, but also as an **alternative** to the use of mineral **fertilisers** in **lettuce cultivation**, allowing not only to use a wasted waste stream, but also to **increase** the **circularity** of agriculture **reducing** the consumption of inorganic **fertilisers**.

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