COMPOST STREAM AS A POTENTIAL BIOMASS FOR HUMIC ACID PRODUCTION:

FOCUS ON COMPOST SEASONAL AND GEOGRAPHICAL VARIABILITY

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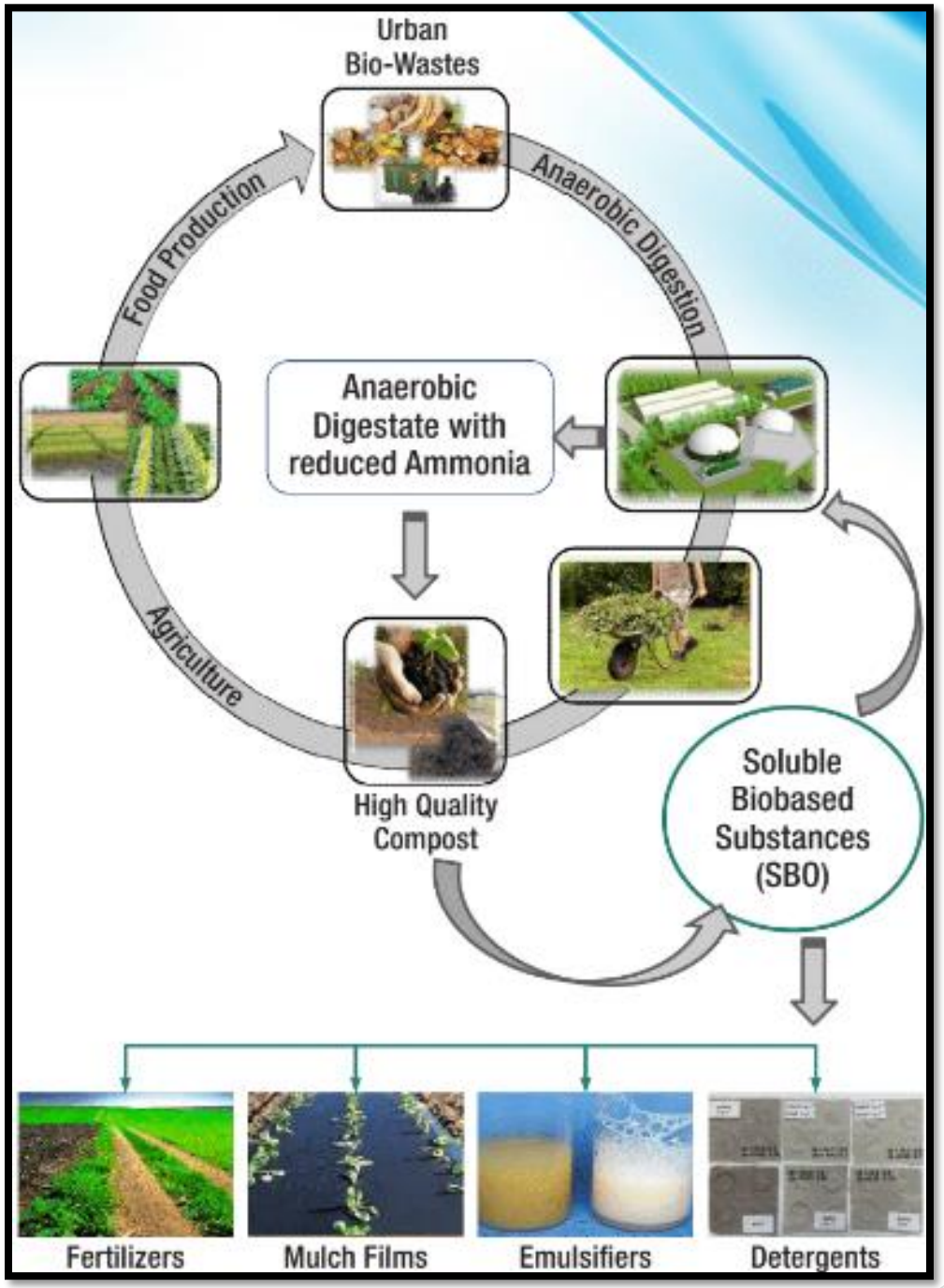
Outline

- Overview: **LIFECAB project**
- Aim of the work
- Materials and methods
- Results
- Conclusions
- Next steps

Overview:
LIFECAB project

- Lifecab is a project granted under by EASME on LIFE Environment and Resource Efficiency Program LIFECAB - LIFE16 ENV/IT/000179.
- Compost is rich of humic and fulvic acids, which make it an excellent soil fertilizer.
- These soluble biological substances (SBO) can be extracted through a completely green process developed by HYSYTECH at pilot scale, whose main core is the hydrolytic route.
- The SBO compounds can be used for myriads of industrial applications as high-added value bio-molecules, from the formulation of detergents to the production of agriculture bio-stimulants. In addition, new findings in SBO knowledge have witnessed the SBO capacity in reducing the ammonia content in the digestate of anaerobic digestion.
- The properties of the compost significantly affect not only the yield of the SBO extraction project but also the quality of SBO.

Overview: LIFECAB project



Aim of the work

This work addresses the collection of analytical data in order to monitor the seasonal and geographical variability of the compost.

4 SEASONS (started in SEPTEMBER 2017, NOVEMBER 2017, FEBRUARY 2018 and APRIL 2018)

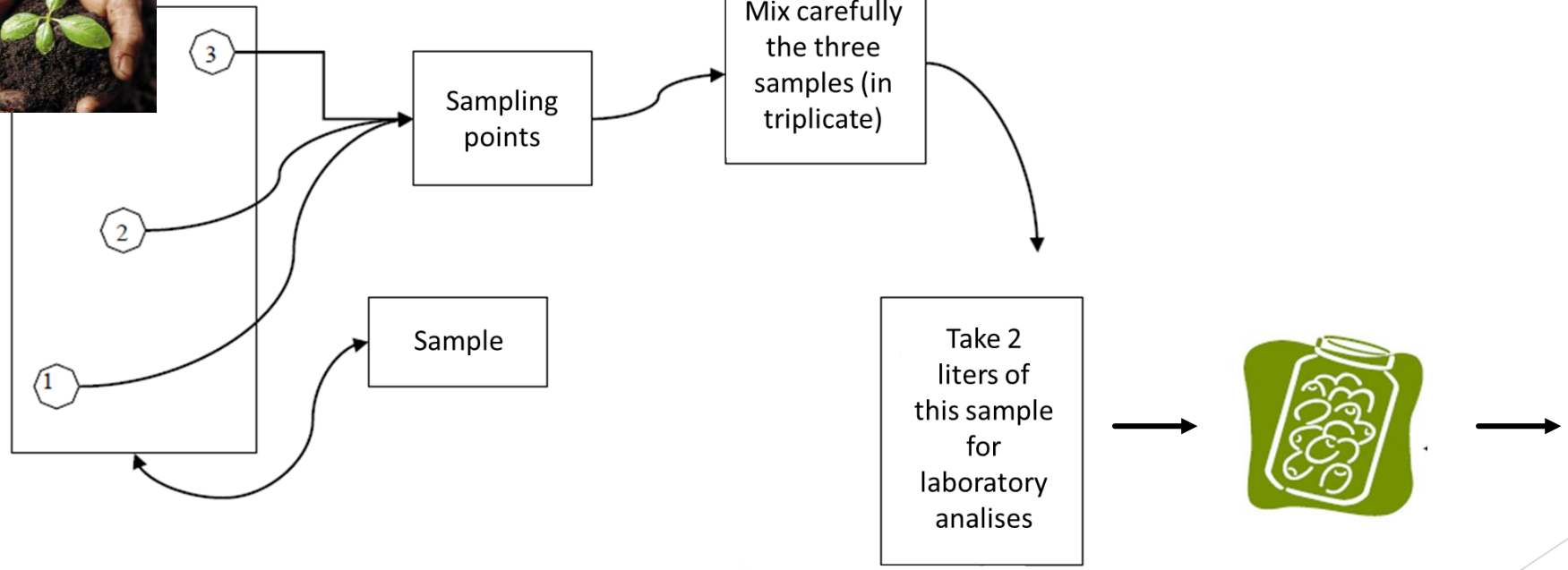
3 EUROPEAN COUNTRIES (Italy, Cyprus and Greece)

→ To build a robust database for providing future relationships between compost parameters and the solube biobased compound (SBO) yield extraction

Materials and Methods: ACEA composting process

For the three composting plants set in Italy, Greece and Cyprus, we have selected a common procedure **for compost sampling and compost analyses***.

To obtain a homogeneous composite sample and have confrontable results from stardardized methods



Parameters:
pH
Salinity
VS,
C, %
N, %
C/N

*DIVAPRA, IPLA. Metodi di analisi dei compost. Collana ambiente, Regione Piemonte, 1992

Materials and Methods: compost starting materials

ACEA Sample	Week sampling
Digestate (D)	0
Gardening residue (G)	0
Compost	1
Compost	2
Compost	3
Compost	4
Compost	8
Compost	12

Oxidation phase: Once per week

Maturation phase Once per month

SBLA (from Cyprus) starting materials: mixture of leaves, pruning, grass, soil and saw dust

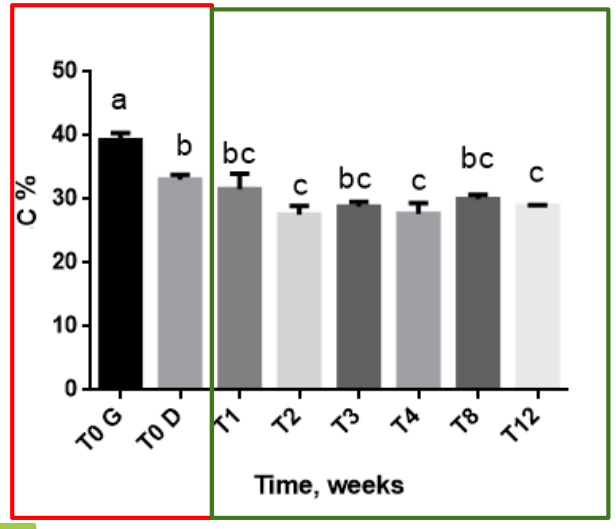
OT (from Greece) starting materials: mixture of olive mill solid wastes, dried municipal wastes, leaves, saw dust, and wood chips

Results
ACEA compost temporal evolution

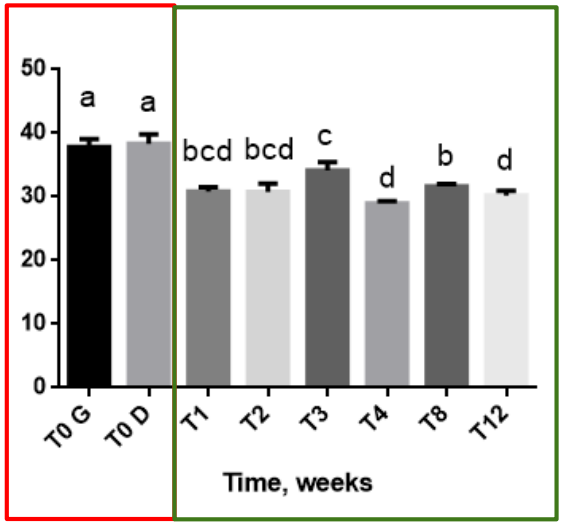
Starting materials
Compost sample

Total Carbon

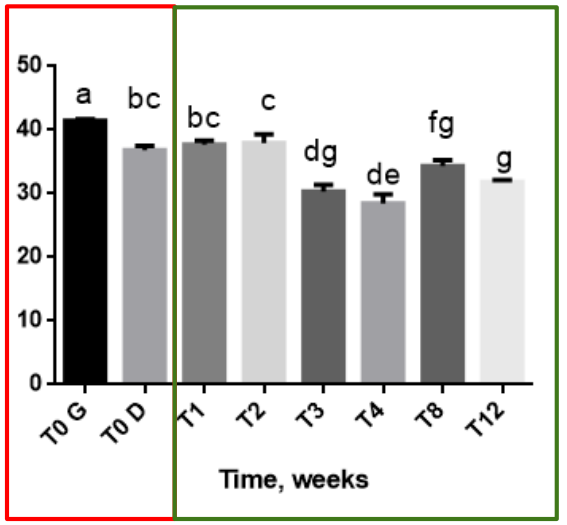
1st season



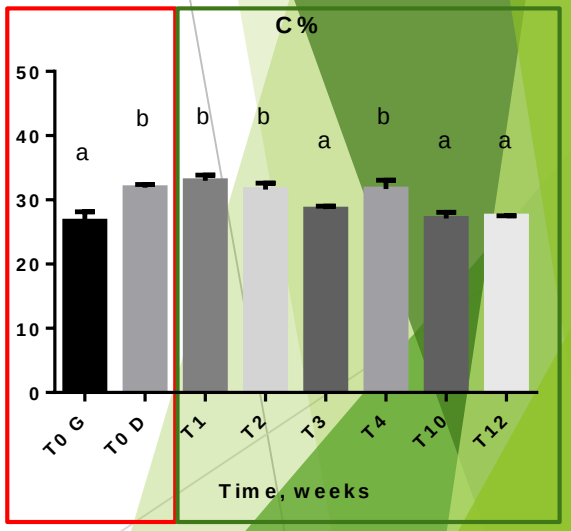
2nd season



3rd season



4th season



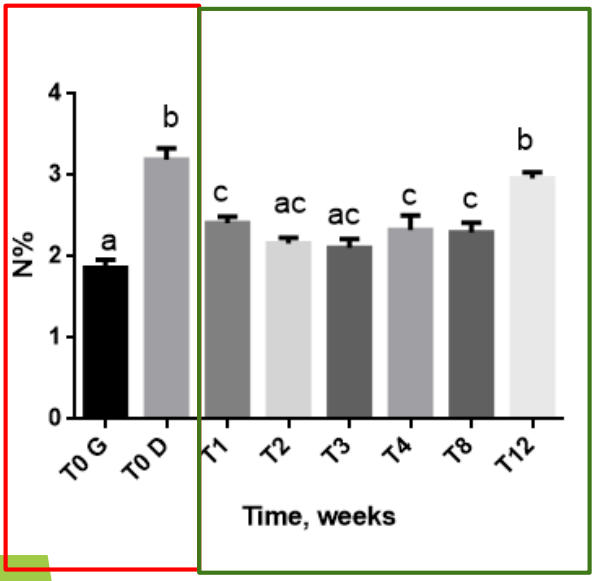
FOUR experimental campaigns started for COMPOST analyses at ACEA site.

Results
ACEA compost temporal evolution

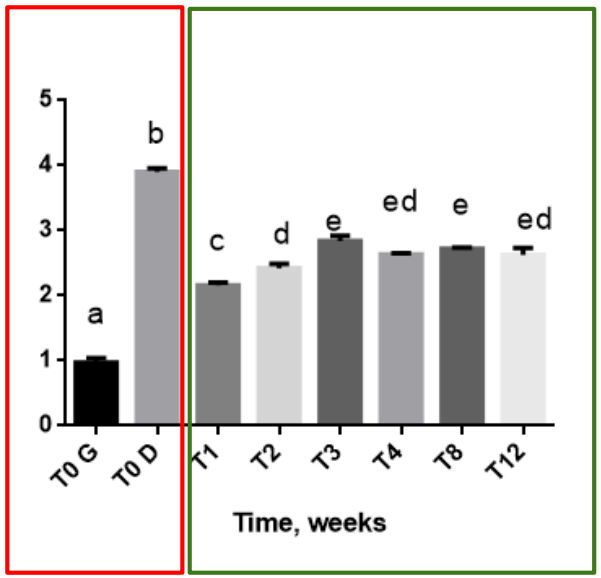
Starting materials
Compost sample

Total Nitrogen

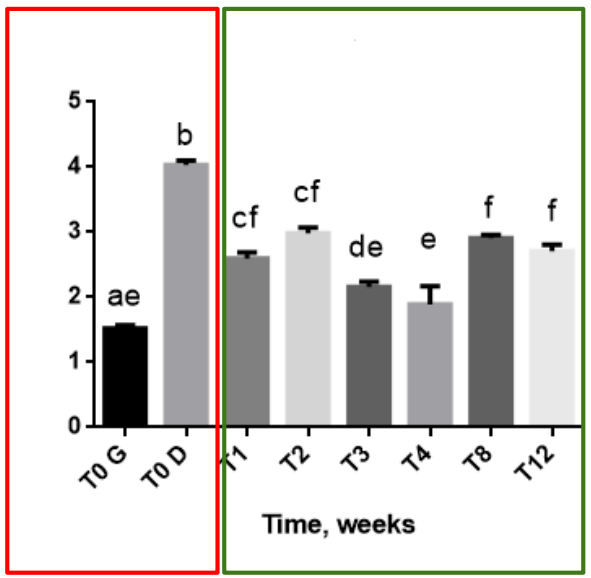
1st season



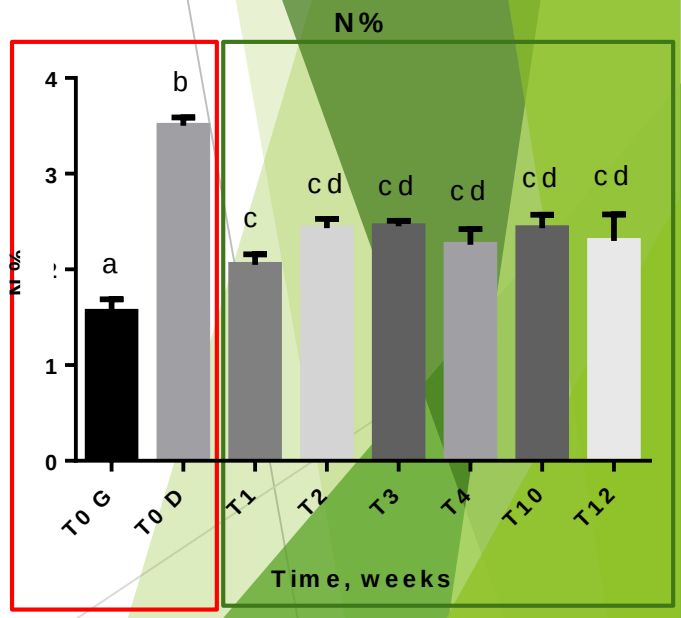
2nd season



3rd season



4th season



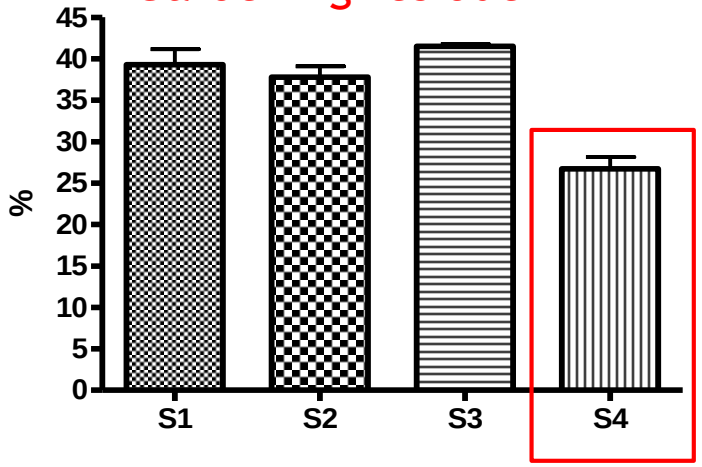
FOUR experimental campaigns started for COMPOST analyses at ACEA site

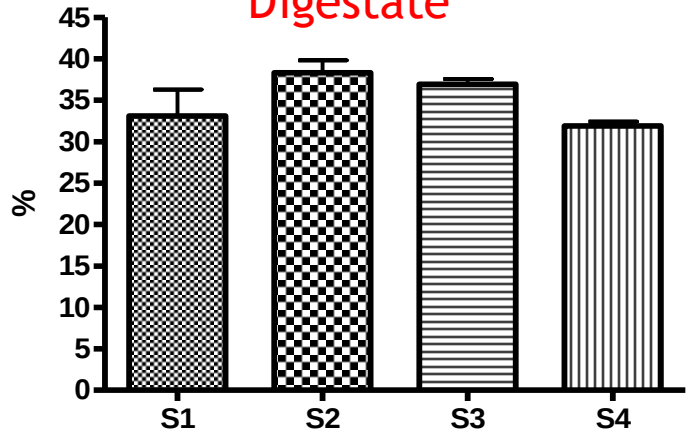
Results
ACEA compost temporal evolution

The main characteristics of the composts did not point out relevant variations during composting. The most significant differences were between the two starting materials (gardening residues and digestate): the digestate exhibited higher pH, salinity, and N content than the gardening residues, which were richer in organic carbon and volatile substances.
These results are in agreement with the nature of the materials.

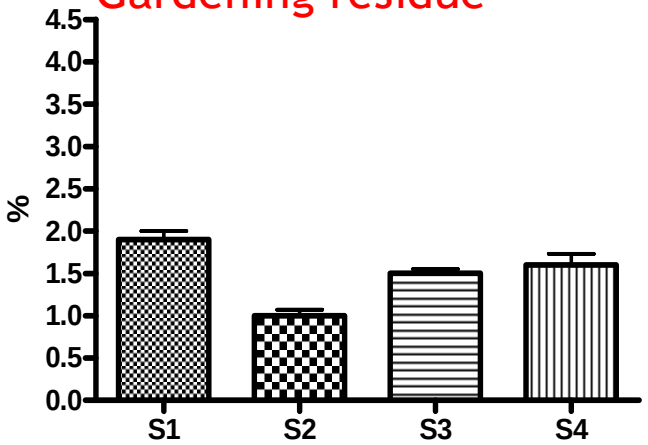
Results
ACEA temporal variability

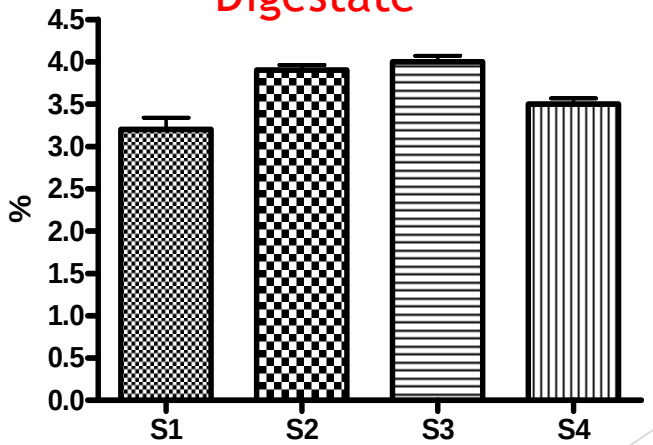
Total C (% TS)





Total N (% TS)





S1: first season

S2: second season

S3: third season

S4: fourth season

Results
ACEA compost seasonal variability

Starting materials

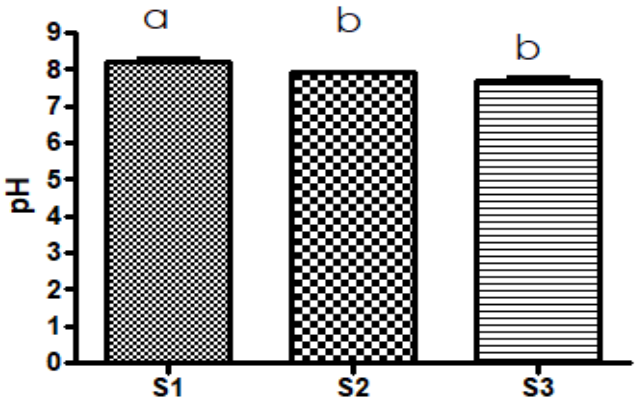
The carbon contents varies only for the gardening residues. This is likely due to the partial maturation of the green wastes during the storage leading to a loss of carbon as CO_2.

The total nitrogen content of both materials were depending on the seasonal sampling. In the case of the digestate, this is likely due to the variability of the kitchen wastes used for the alimentation of the digestor. The variations of the nitrogen content of the gardening residues could be due to both the differences of protein content of the lignocellulosic material and the maturation of the pile.

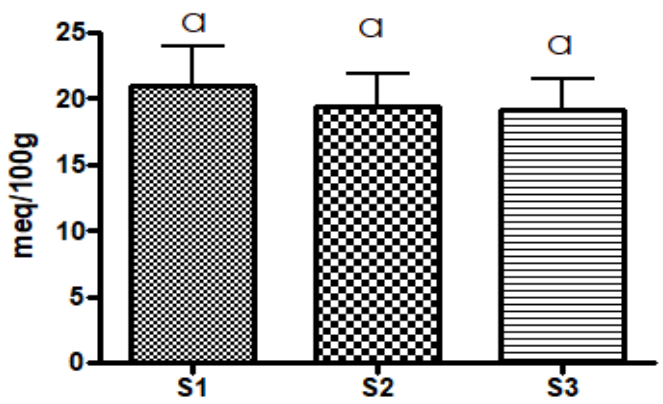
Basically, no significant differences for the starting materials at different seasons for pH and salinity.

Results
ACEA compost seasonal variability

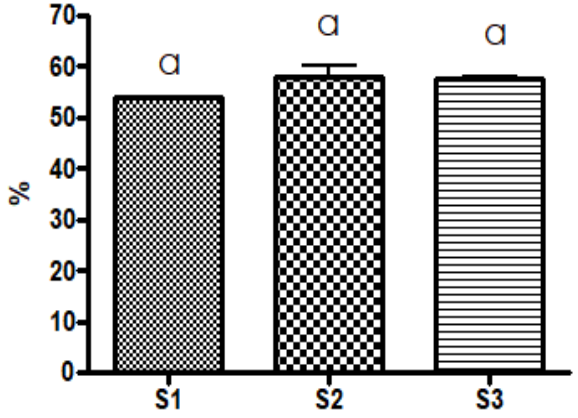
pH



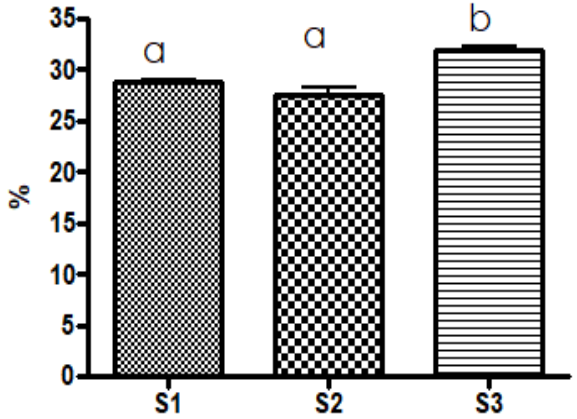
Salinity, meq/100 g



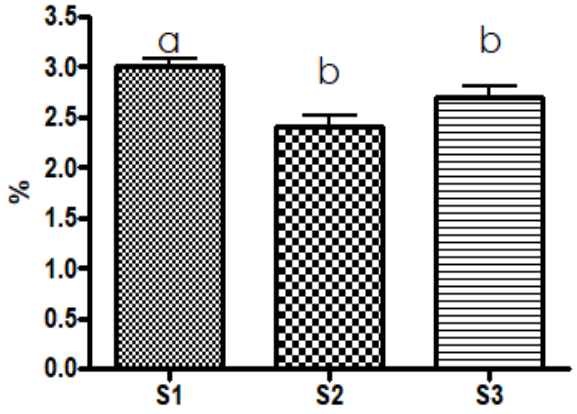
Volatile substances, %



Total C, %



Total N, %



S1: first season

S2: second season

S3: third season

*Data refer to MATURE COMPOST analyzed at three different seasons.

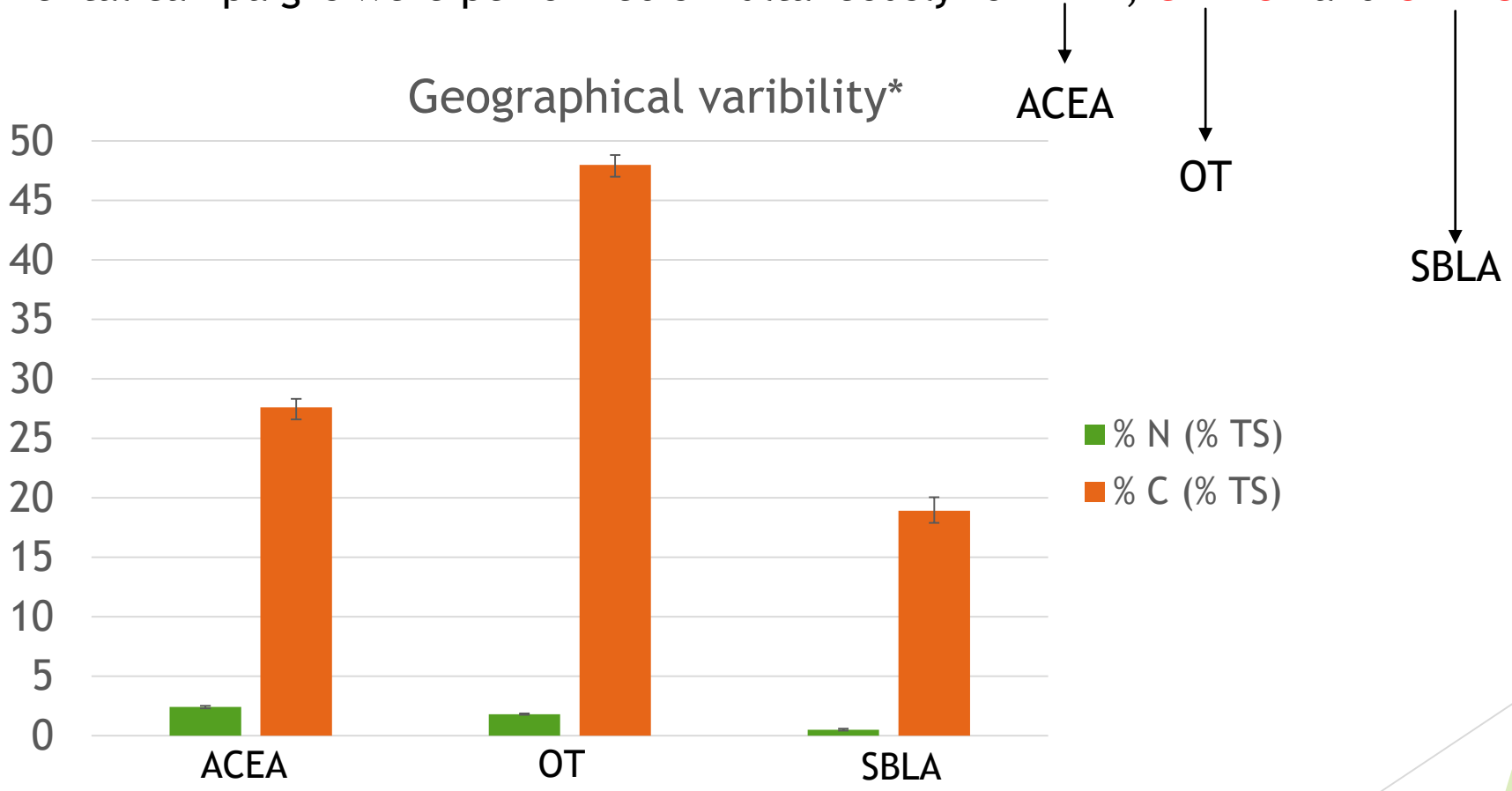
Results
ACEA compost seasonal variability

Final compost

The comparison between the composts obtained during the four completed seasons pointed out some significant differences as far as the carbon and nitrogen content were concerned. The observed trend is an increase of C and a decrease of N from season 1 to season 3, reflected as an increase of the C/N ratio.

Results
compost geographical variability

The experimental campaigns were performed simultaneously for ITALY, GREECE and CYPRUS.



*Data refer to the second season for MATURE COMPOST.

Results:
compost geographical variability

Significant differences for the geographical variability, which requires futher assessments.

It mainly depends on the typology of the starting materials since ACEA utilized digestate and green residue, while OT and SBLA only green residue.

Conclusions

- We have investigated the temporal evolution during the composting process, the seasonal variability over four seasons and the geographical varibility over tre European contries (Italy, Greece and Cyprus).

- We have found out that the main characteristics of the composts did not point out relevant variations during composting. The most significant differences were between the two starting materials (gardening residues and digestate).

- The seasonal variability affected the total nitrogen and carbon content, not only for the mature compost, but also for the starting materials (digestate + green residue).

- The Italian compost was compared with the one deriving from Greece and Cyprus. Significant differences for the geographical variability were noticed (it depends also on the typology of starting materials).

Next steps

- Repeating the compost analyses for the next four seasons on the mature compost produced in Italy, Greece and Cyprus in order to create an extensive compost database. The additional data will validate (or reject) the first year analysis round.

- The first year analyses for compost characterization should provide information for drawing relationships between compost parameters and SBO (soluble compounds) quality and yield from compost extraction. This is the main core of Lifecab project and it will be performed at the beginning of 2019.

Project granted under by EASME on LIFE Environment and Resource Efficiency Program LIFECAB-LIFE16 ENV/IT/000179

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"Good decision-making about how we manage the waste we create is one of the most important contributions humanity can make to reducing its impact on the natural world."

ISWA Global Waste Management Outlook foreword, 2015

Thank you for your attention

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