

# agrimax

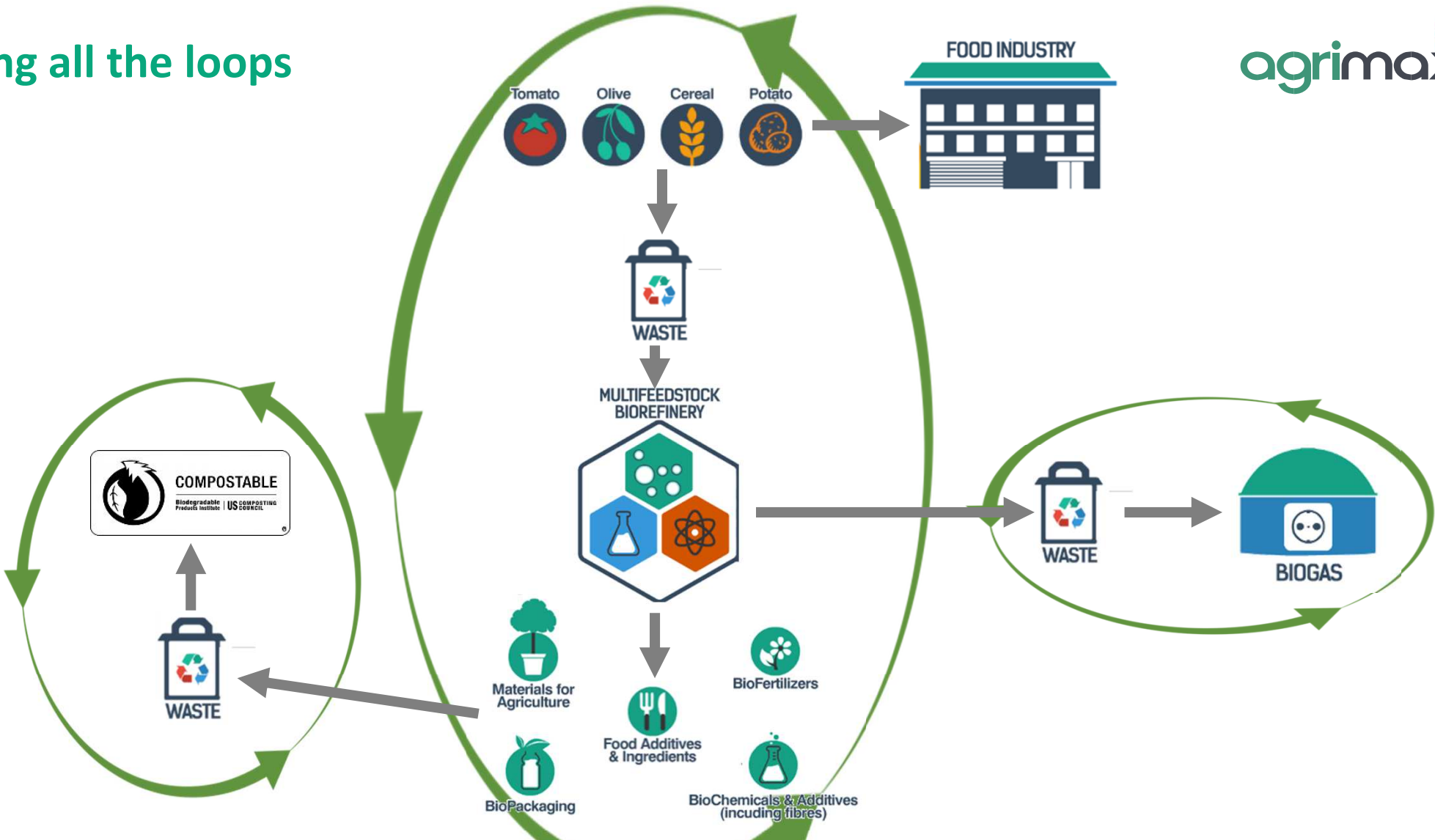
## Webinar: Closing the loop: using residual biomass for energy recovery – organic recycling

Filip Velghe  
15<sup>th</sup> April 2021



This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No. 720719.

# Closing all the loops

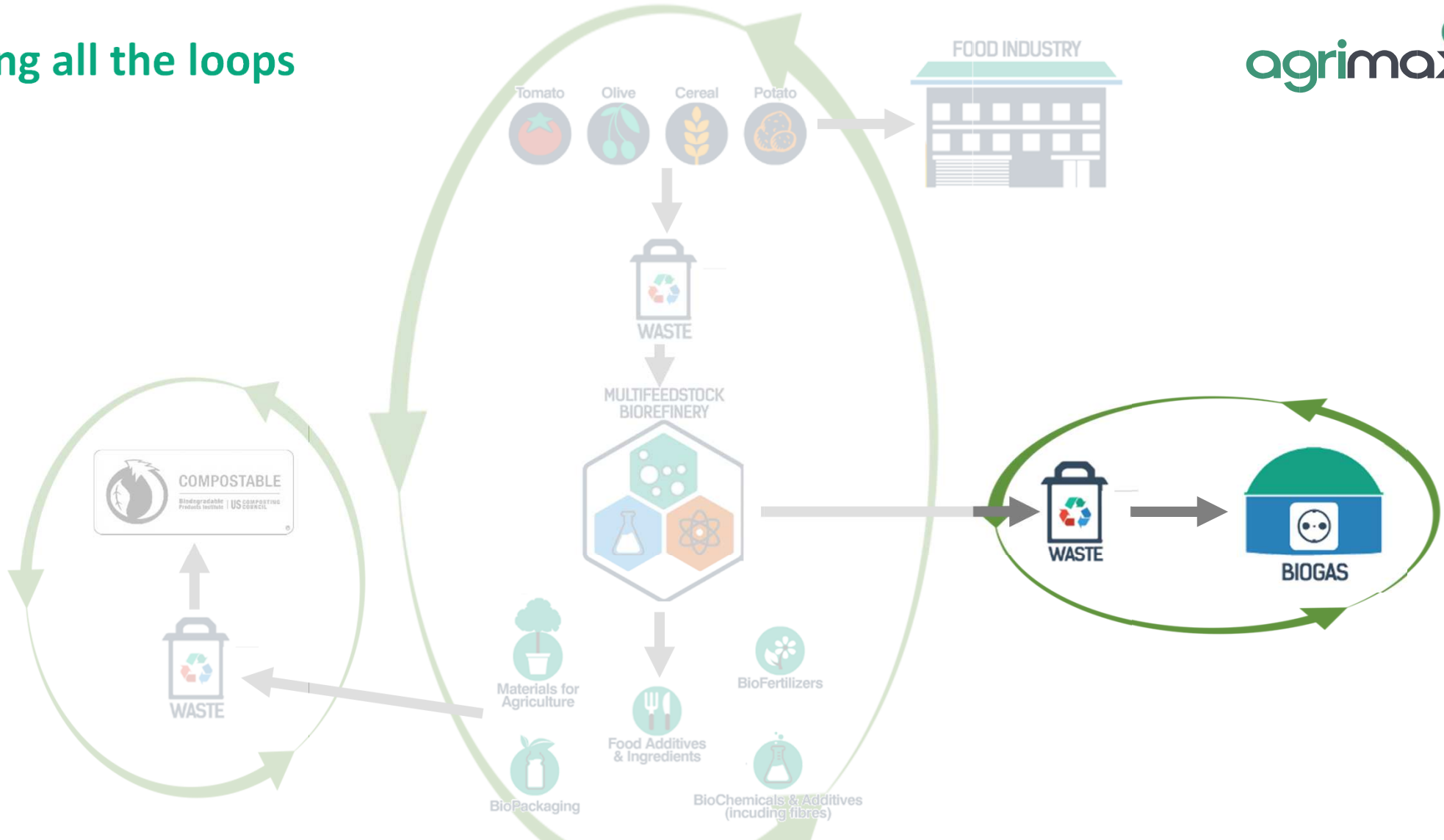


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# Closing all the loops



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# Using residual biomass for energy recovery

Batch evaluation: maximum biogas potential



Continuous testing: long term stability and maximum loading rate



# Using residual biomass for energy recovery → Batch

1 kg active inoculum  
+  
10 – 100 g test substrate

Incubated at 52°C in absence of oxygen

All gas is collected

14 days (or until plateau)

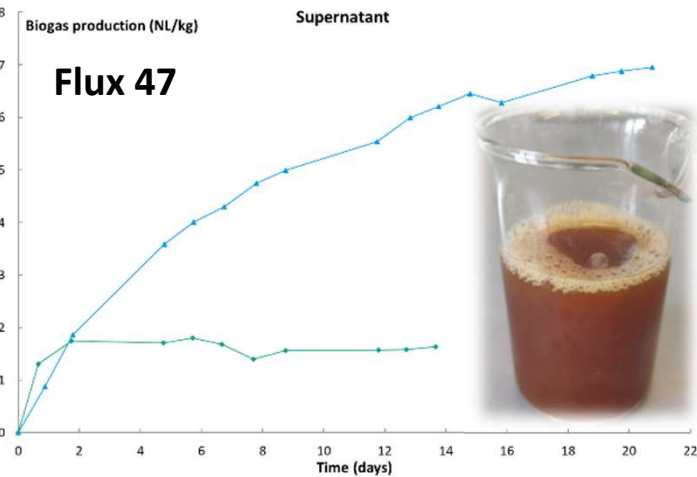
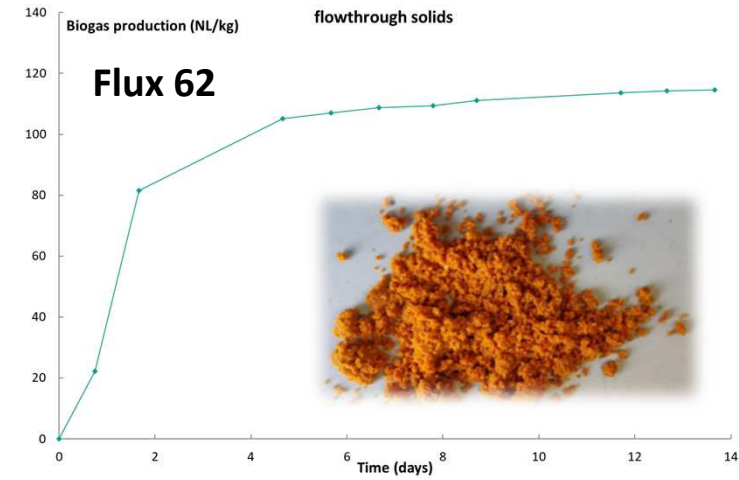
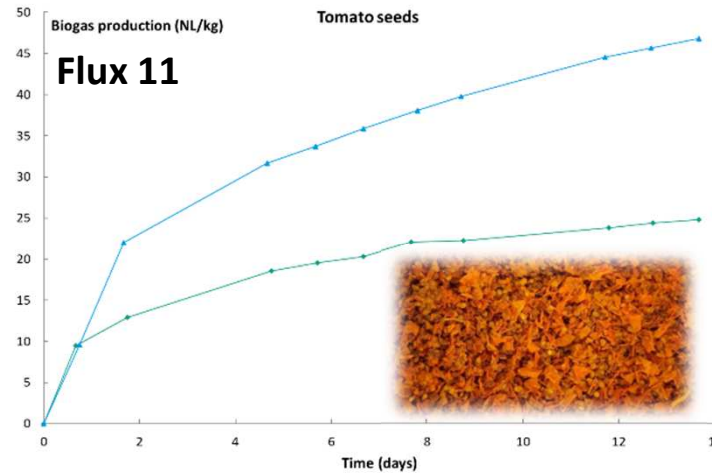
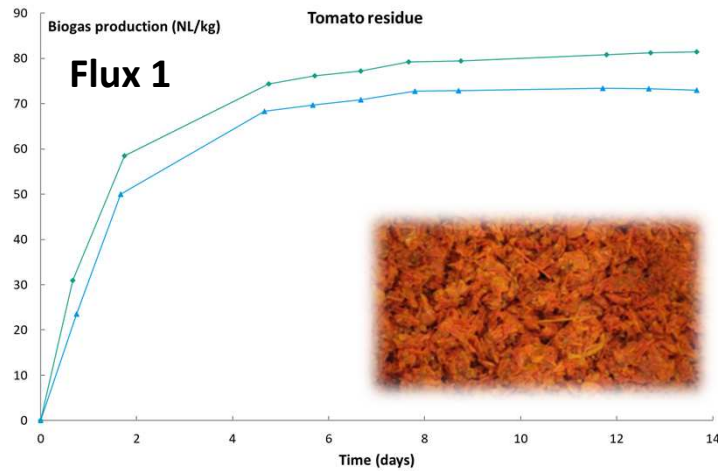
Daily monitoring of biogas production

CH<sub>4</sub>/CO<sub>2</sub> analysis @ end



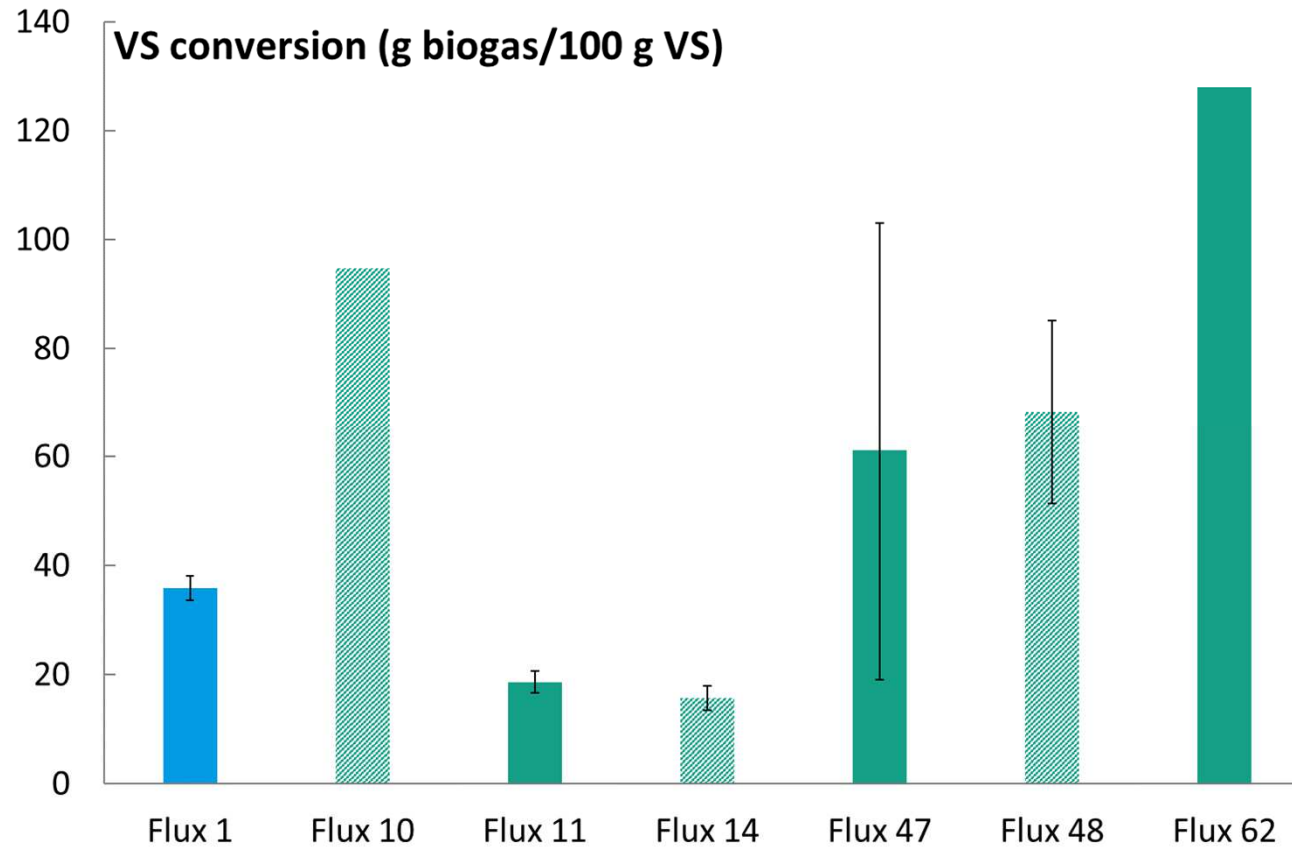
# Using residual biomass for energy recovery → Batch

Tomato residue → cutin/lycopene



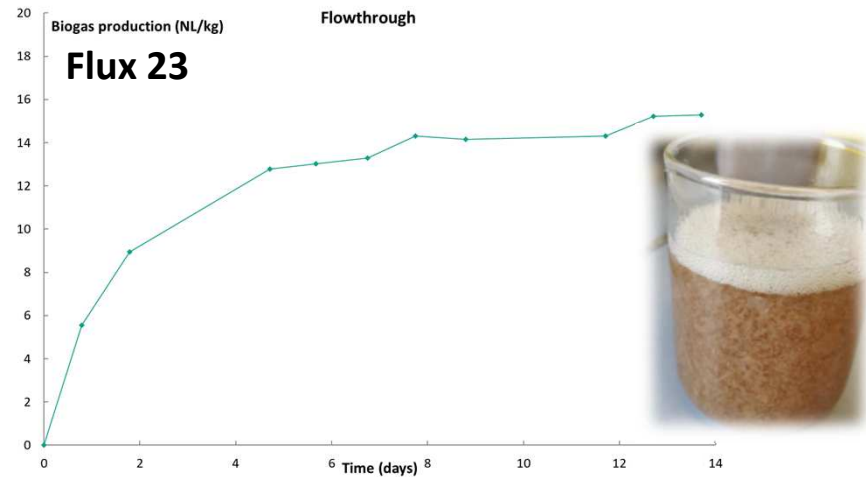
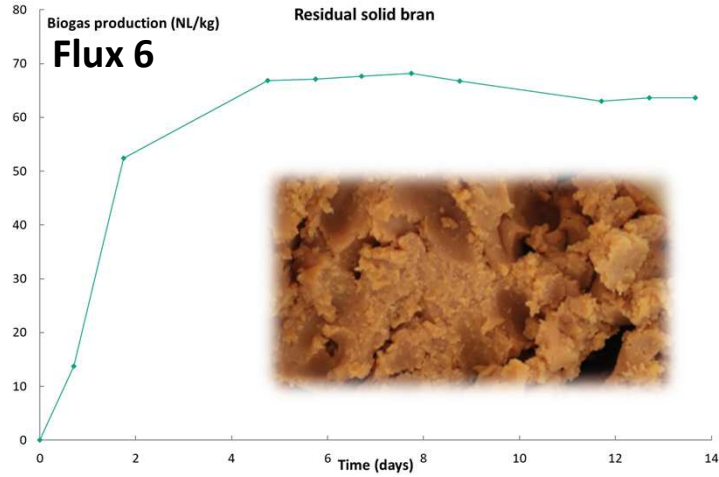
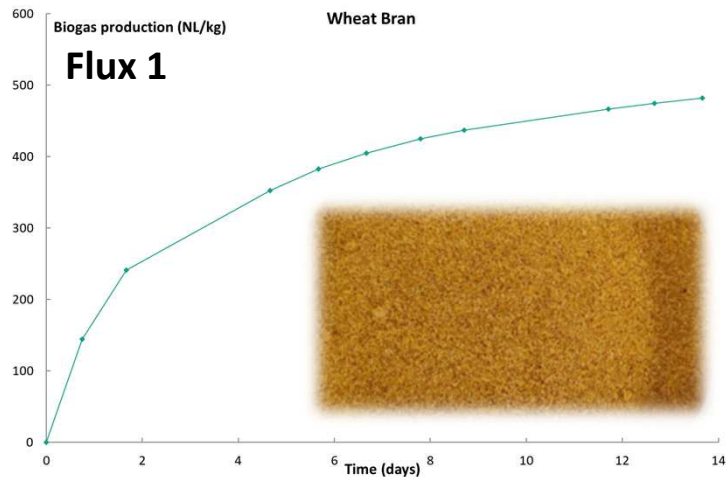
# Using residual biomass for energy recovery → Batch

Tomato residue → cutin/lycopene



# Using residual biomass for energy recovery → Batch

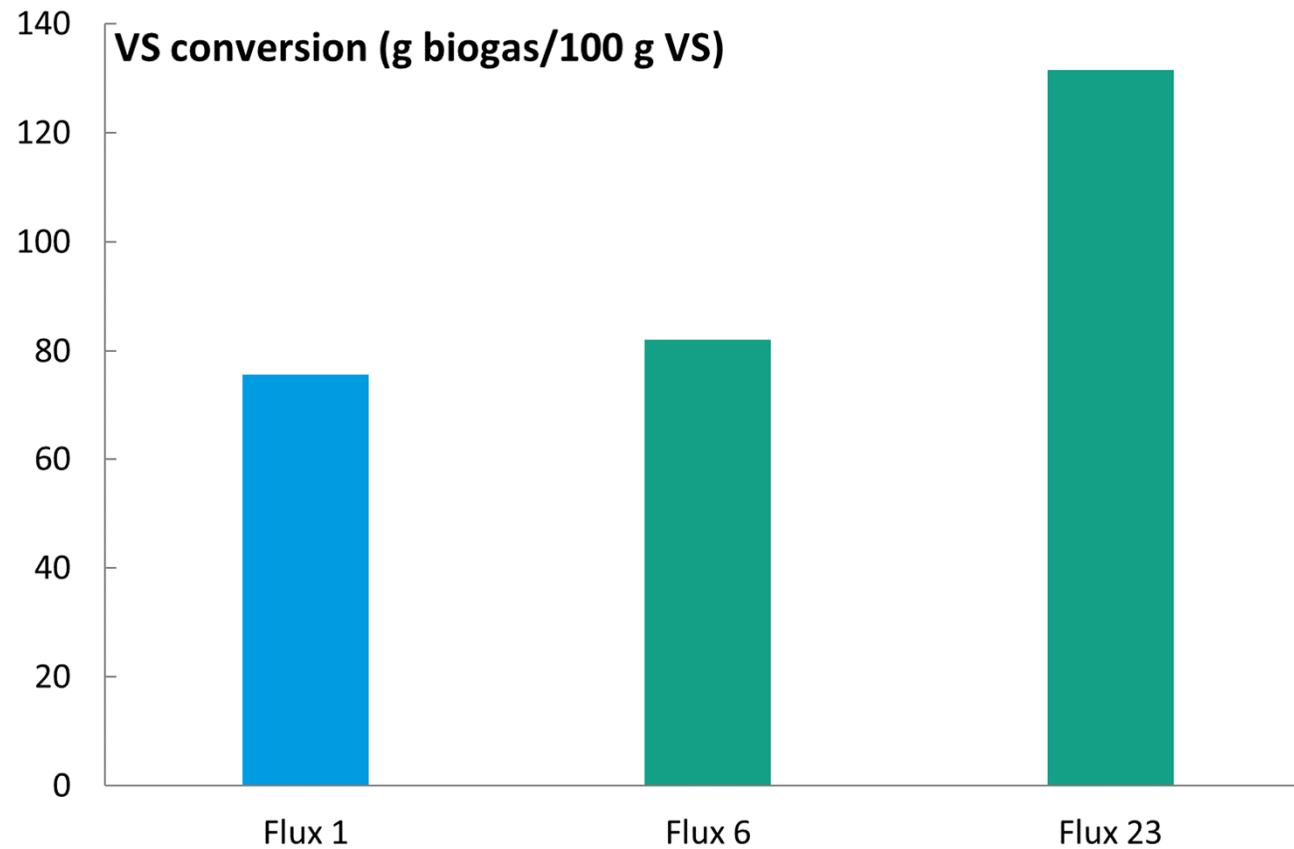
Wheat bran → ferulic acid





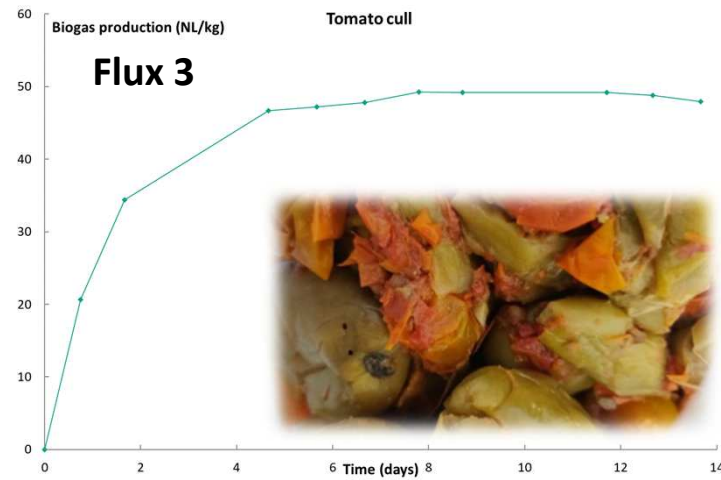
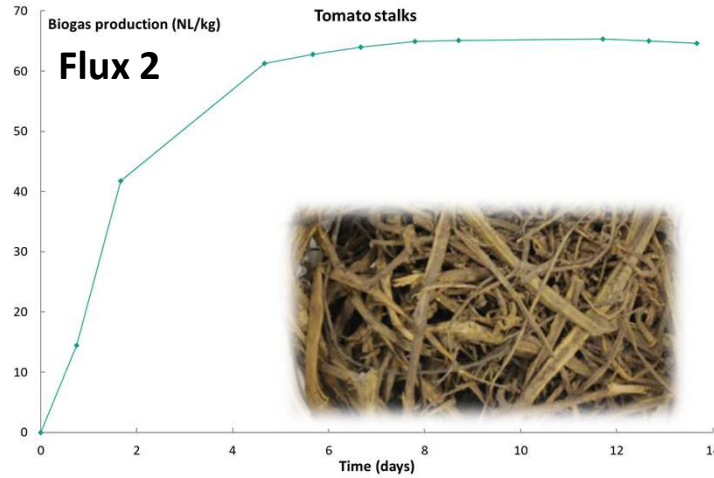
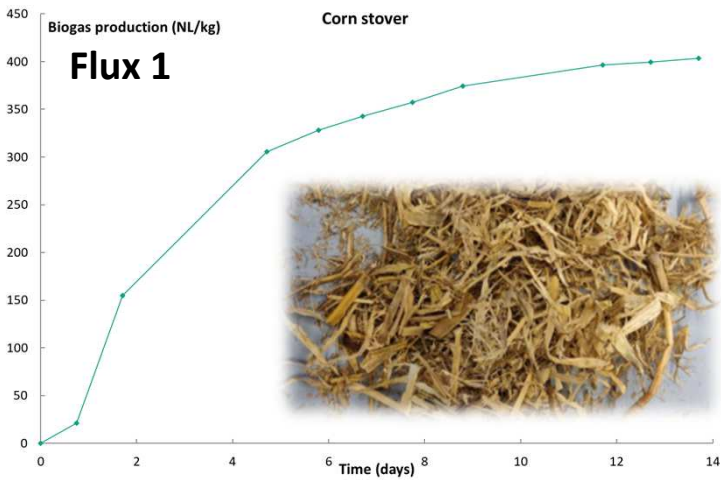
# Using residual biomass for energy recovery → Batch

Wheat bran → ferulic acid



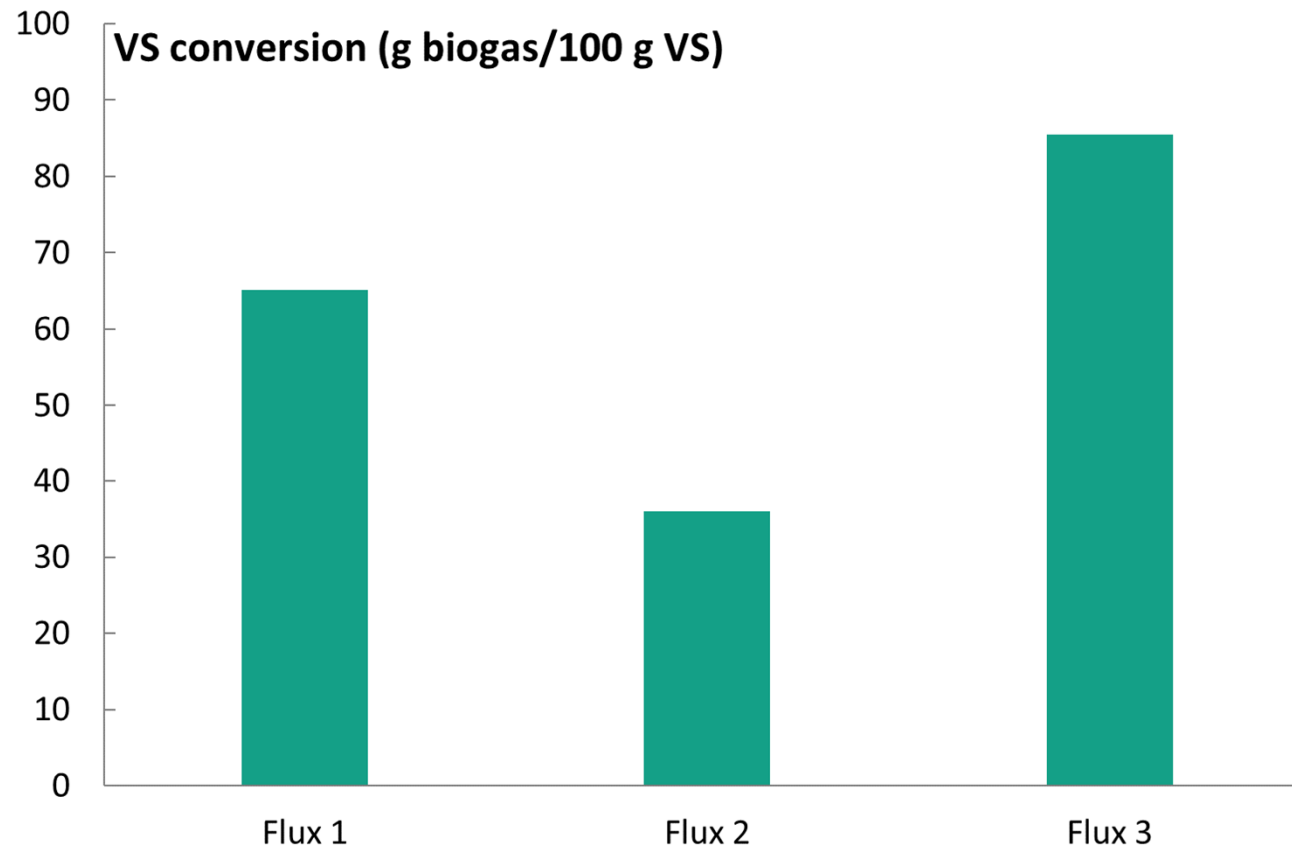
# Using residual biomass for energy recovery → Batch

Residual streams → hydrocompost



# Using residual biomass for energy recovery → Batch

Residual streams → hydrocompost



# Using residual biomass for energy recovery → Continuous AD

2 kg active reactor content

Simulation of full-scale AD

Fed 3 times per week

Temperature 37-52°C

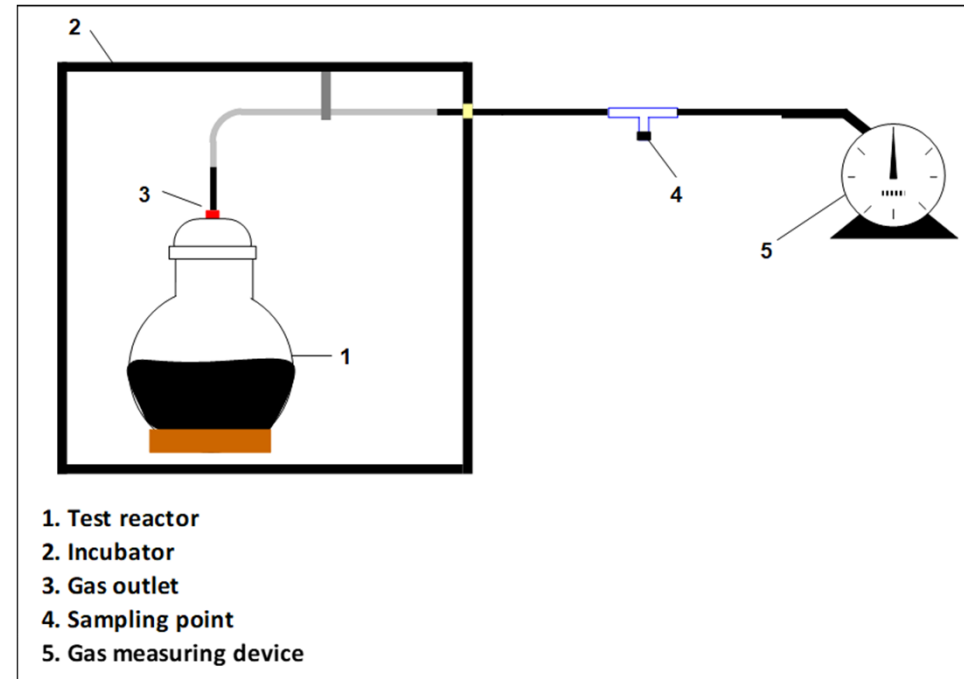
Daily monitoring of biogas production

Weekly biogas and digestate analysis

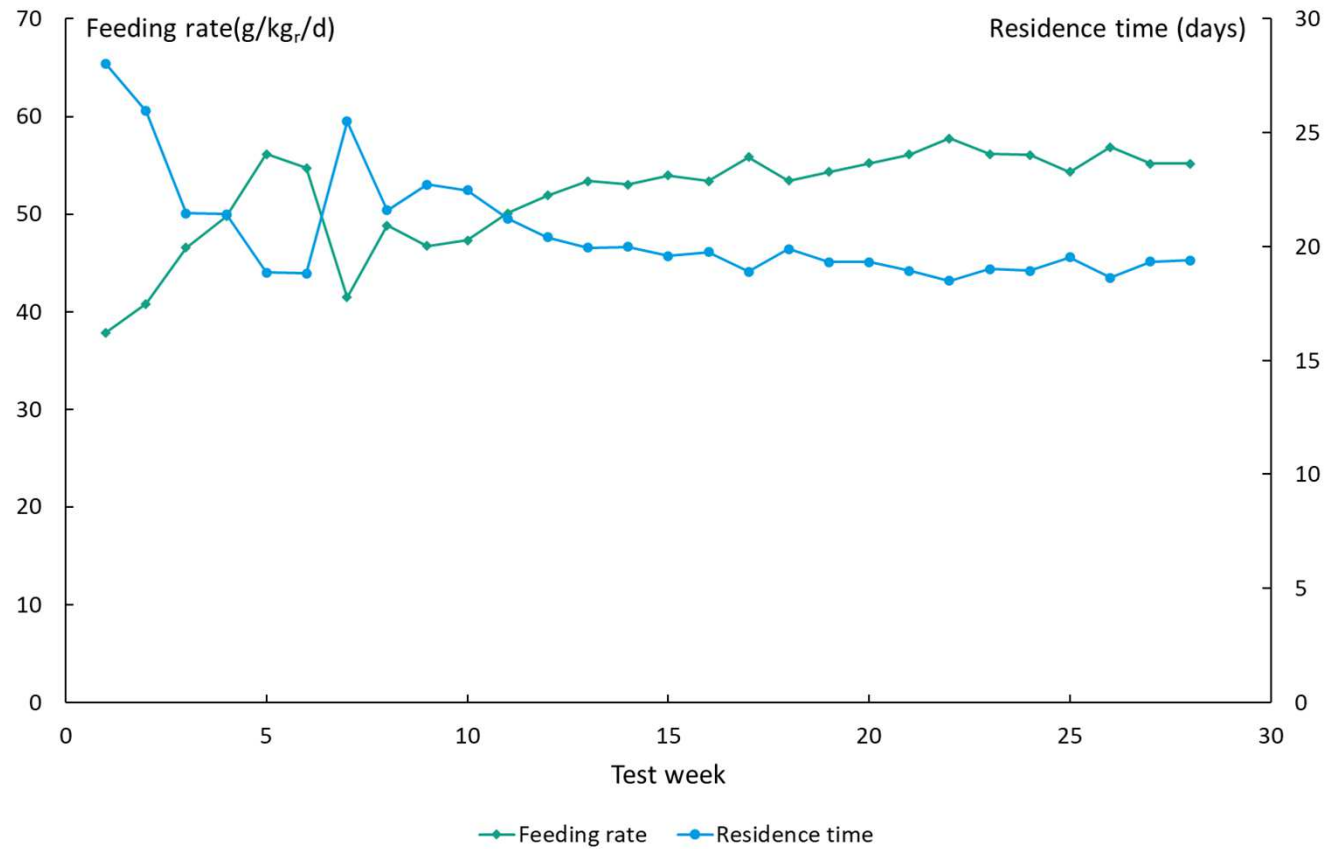
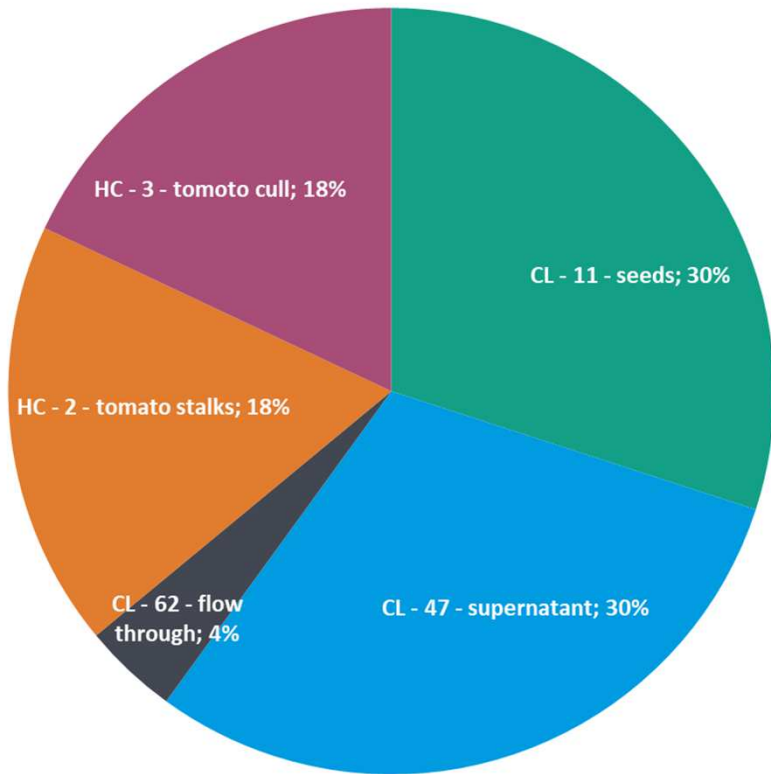
Optimizing input mixture

Maximizing loading rate

Evaluation process stability



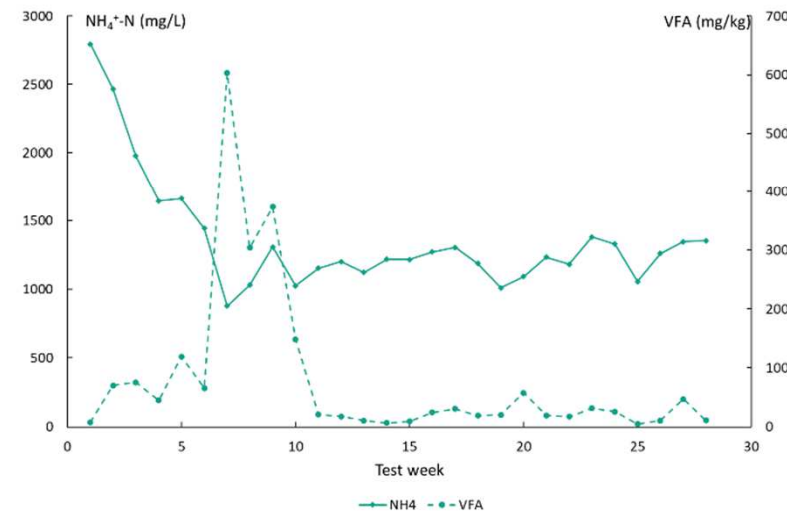
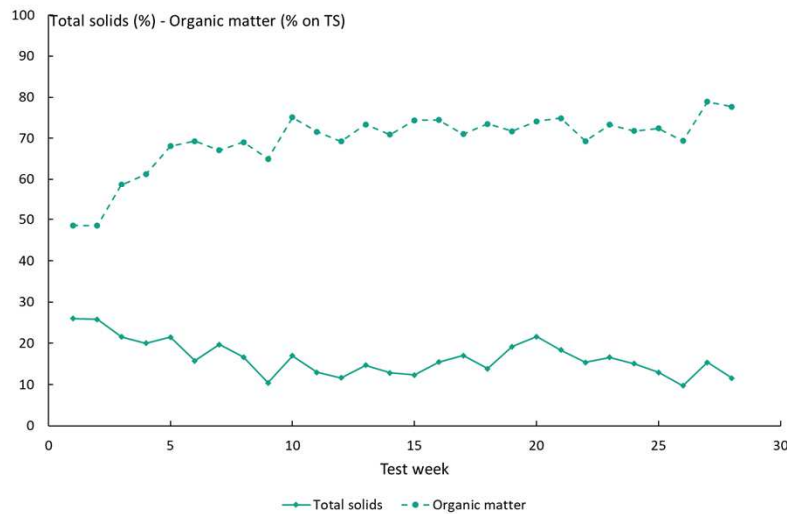
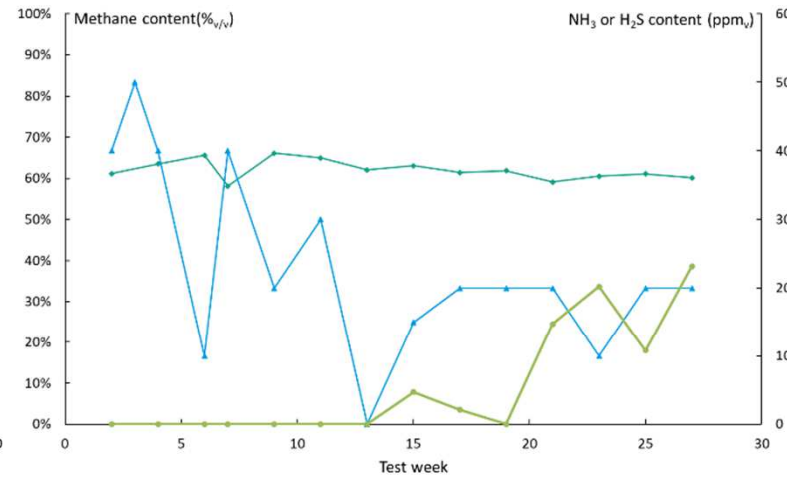
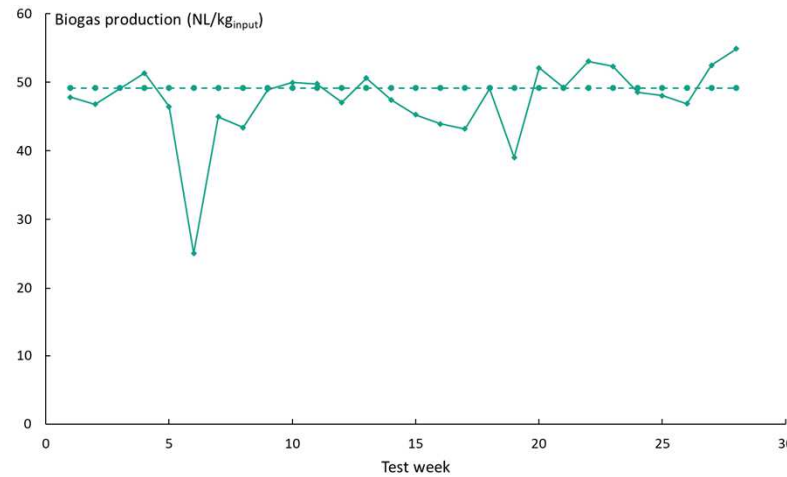
# Using residual biomass for energy recovery → Continuous AD on tomato residues (52°C)



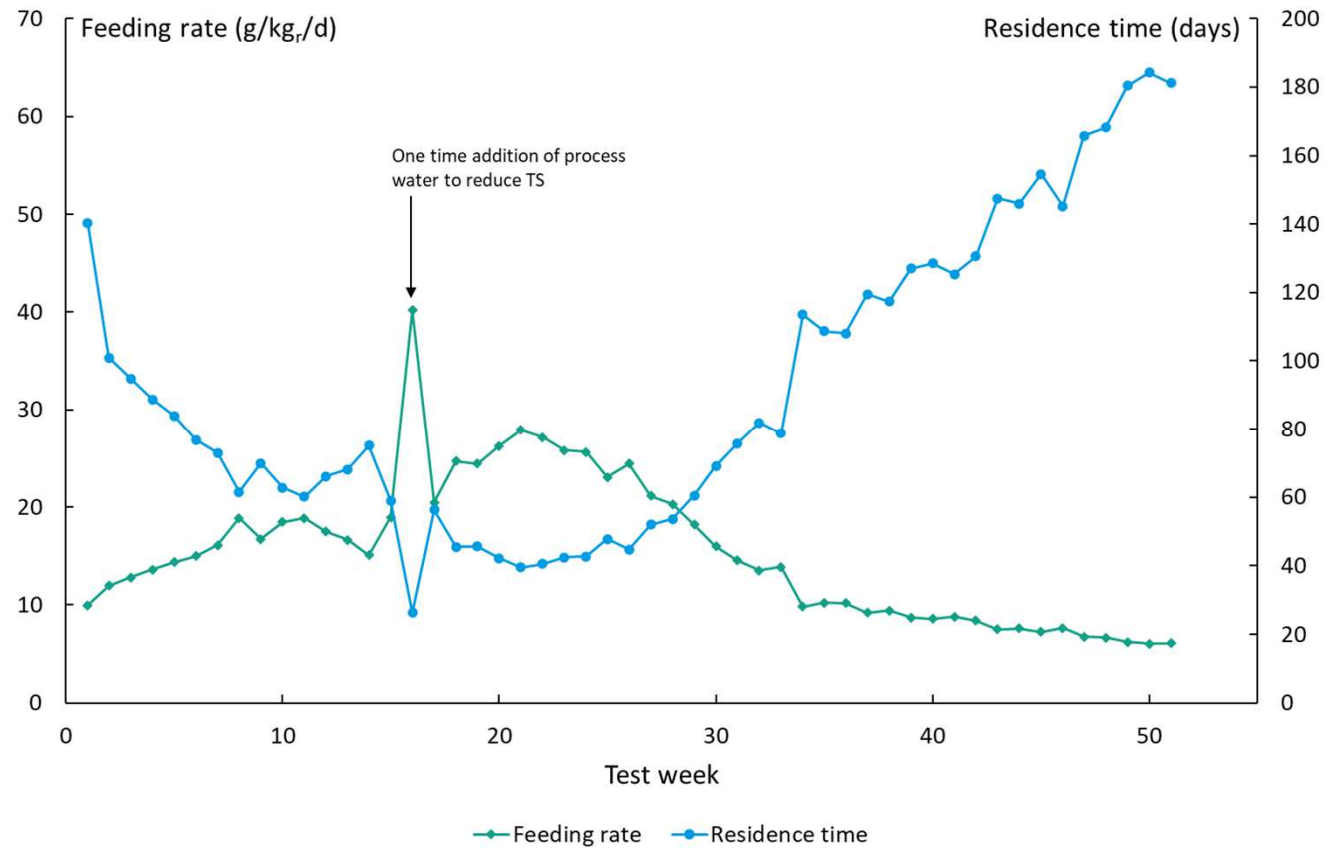
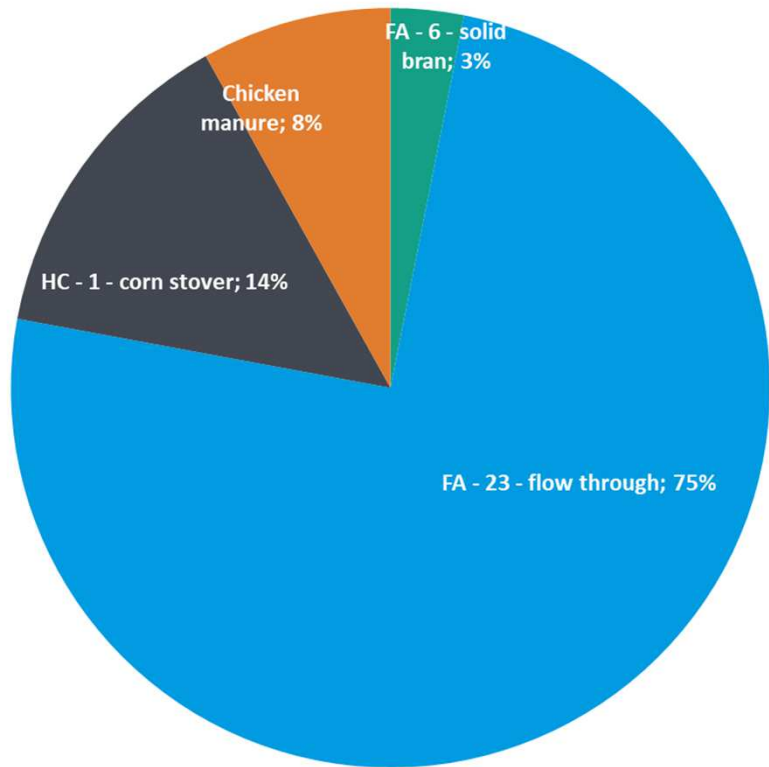


Loading rate of  
4,5 NL/kg/d

# Using residual biomass for energy recovery → Continuous AD on tomato residues (52°C)



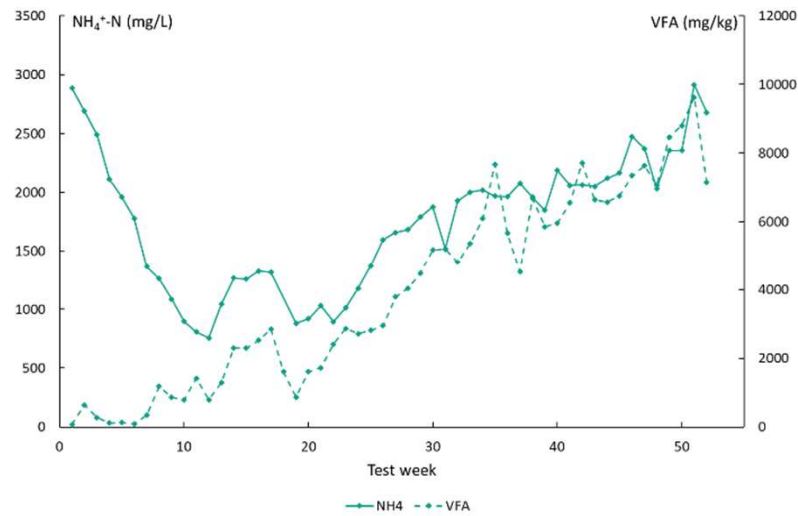
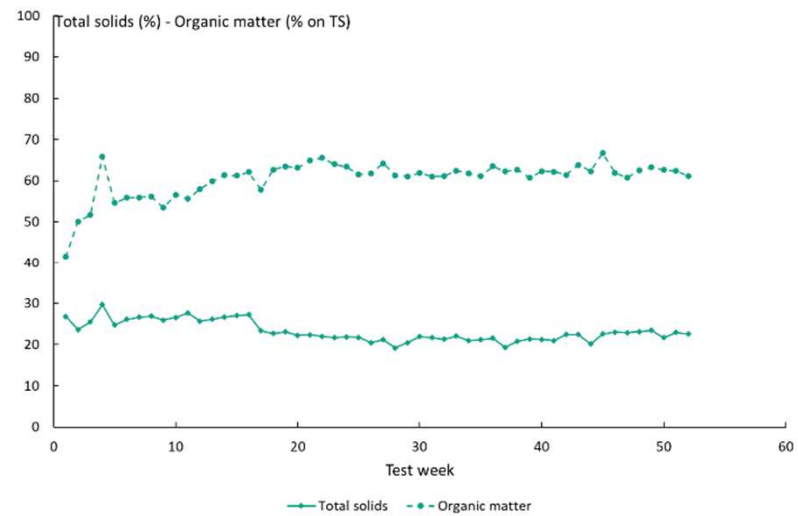
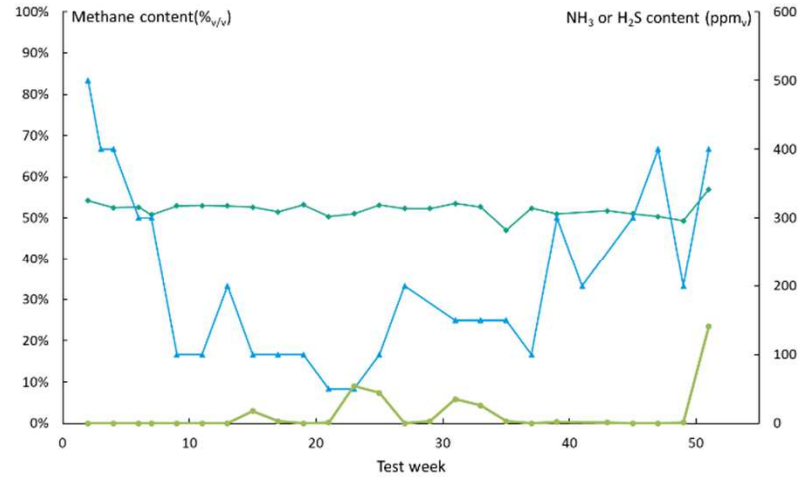
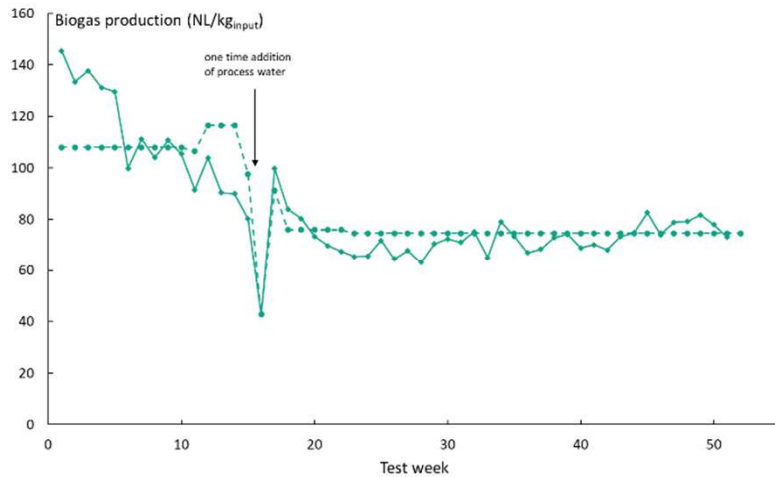
# Using residual biomass for energy recovery → Continuous AD on wheat bran residues (52°C)





Loading rate of  
0,6 NL/kg/d

# Using residual biomass for energy recovery → Continuous AD on wheat bran residues (52°C)



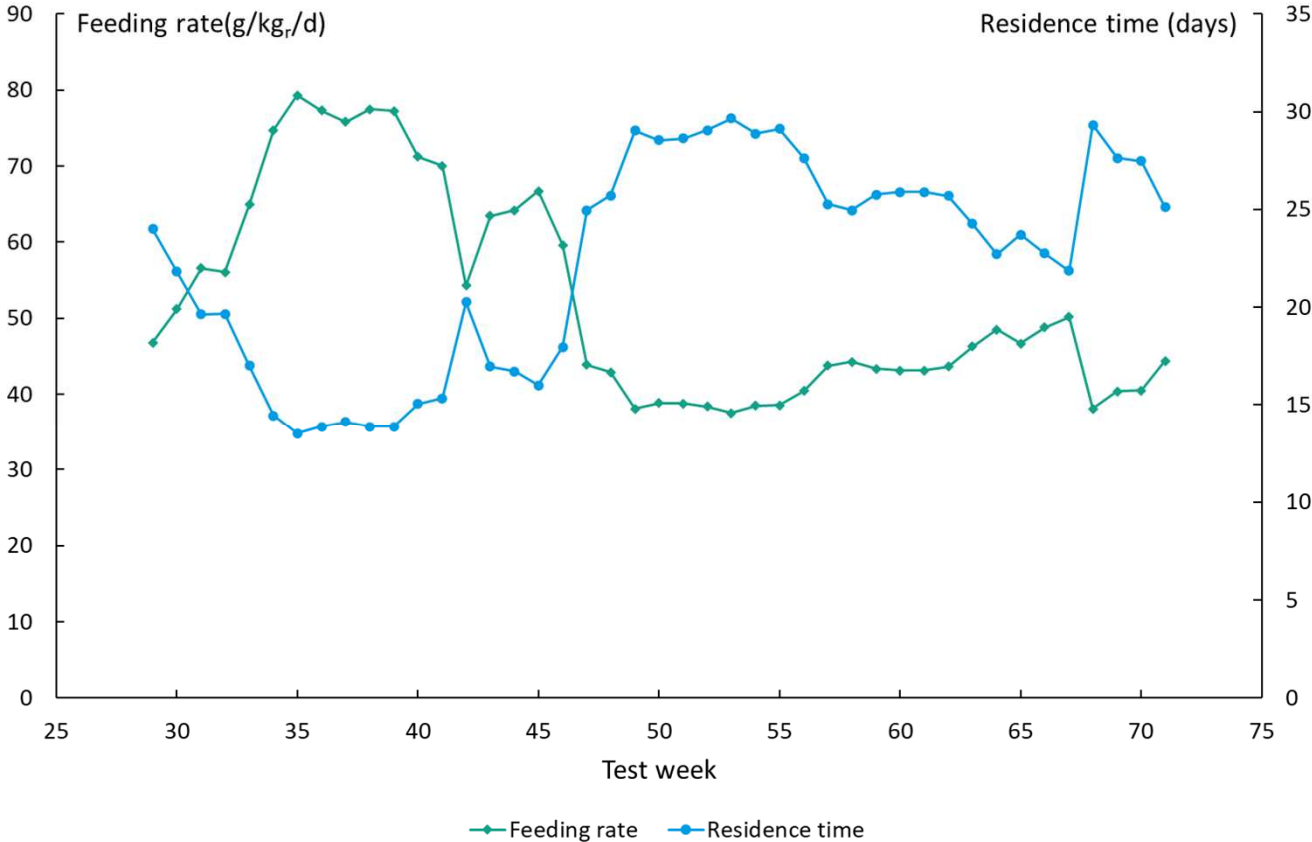
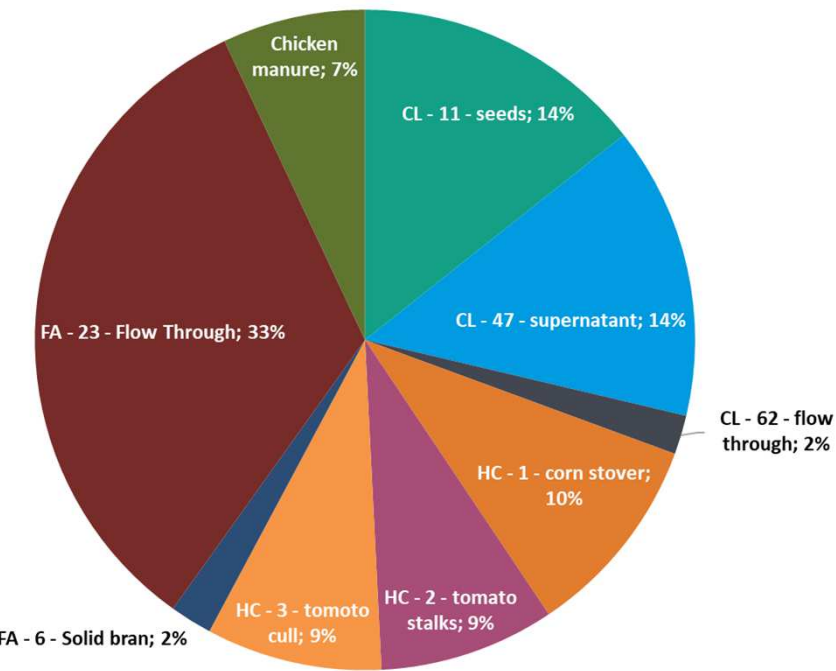
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# Using residual biomass for energy recovery → Continuous AD on combined tomato and wheat bran residues (52°C)



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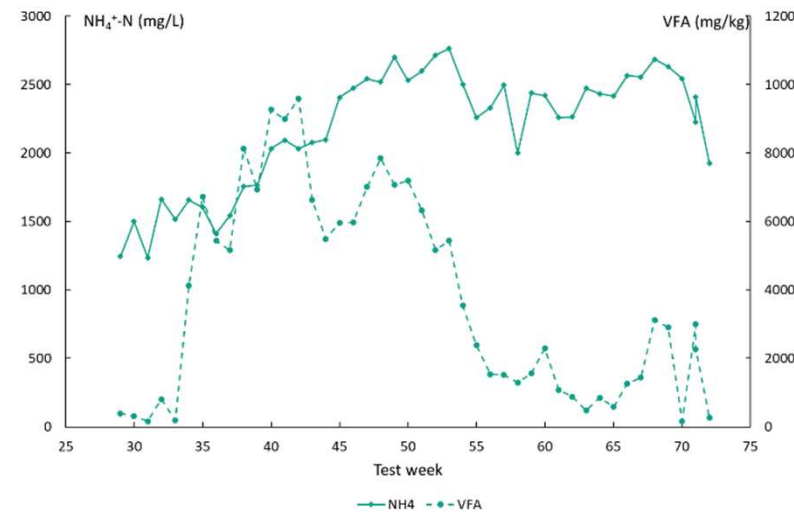
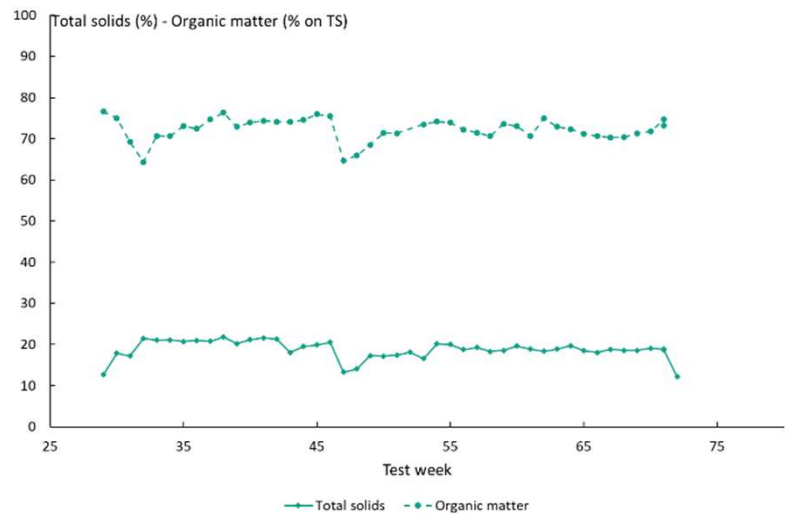
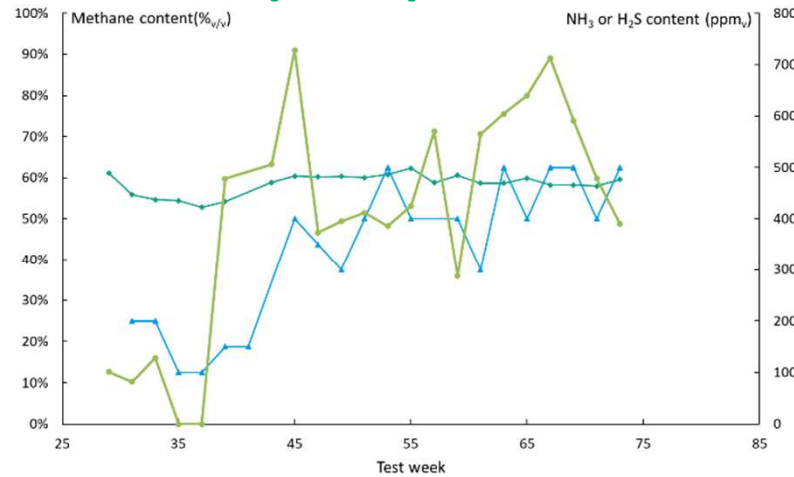
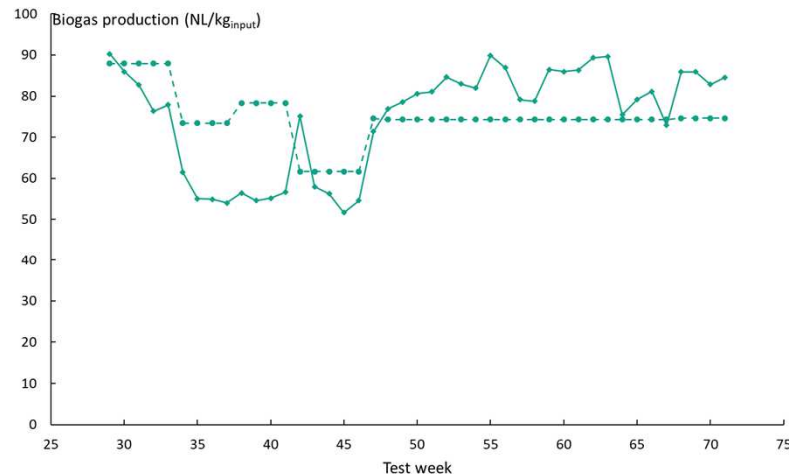
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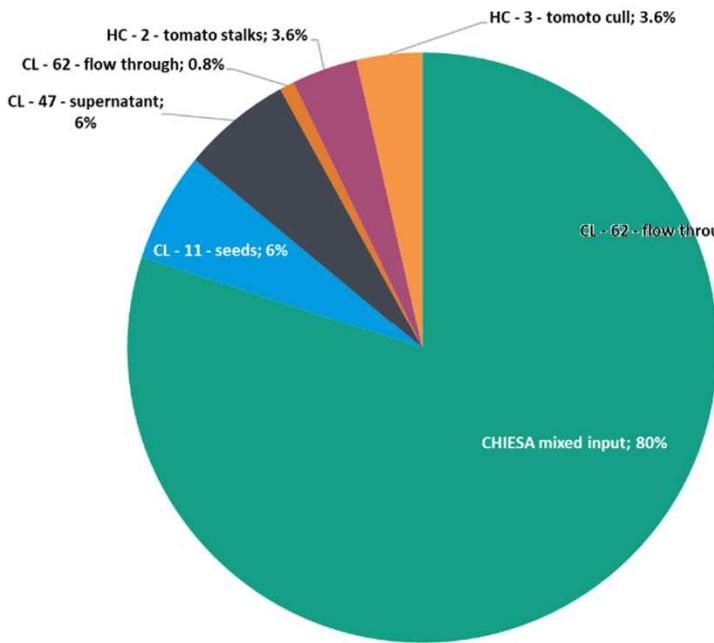


Loading rate of  
3,5 NL/kg/d

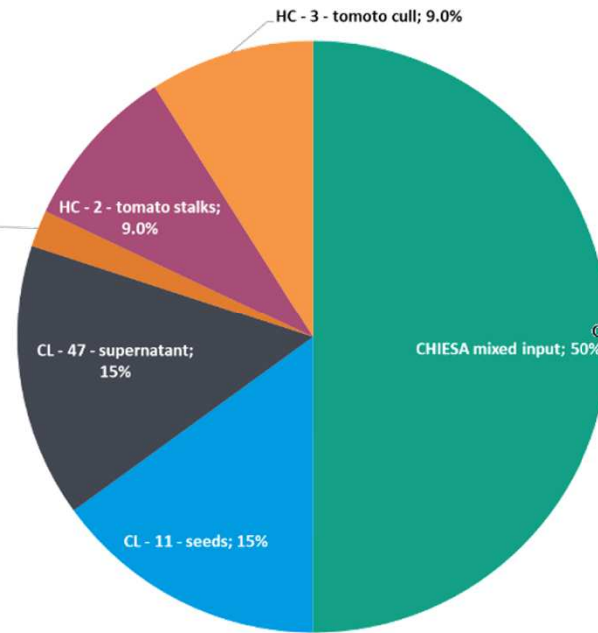
# Using residual biomass for energy recovery → Continuous AD on combined tomato and wheat bran residues (52°C)



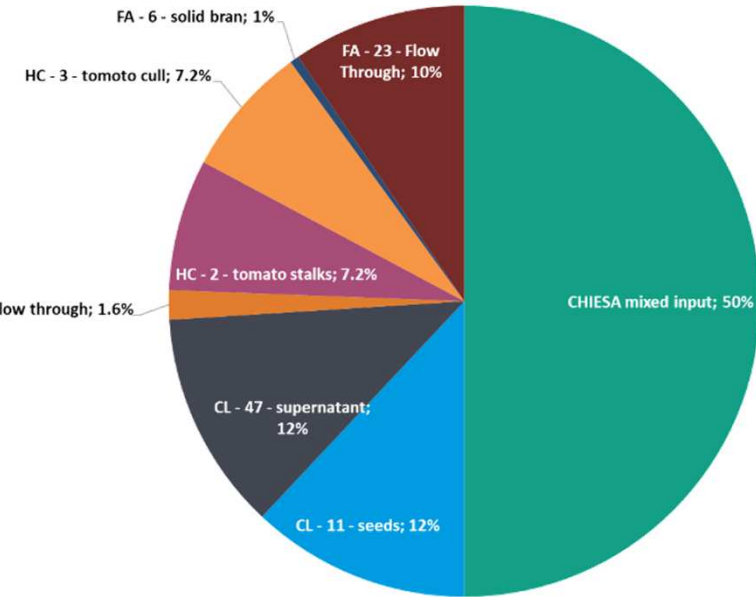
# Using residual biomass for energy recovery → Continuous AD of AgriMax residues as co-substrates (42°C)



Week 1-22

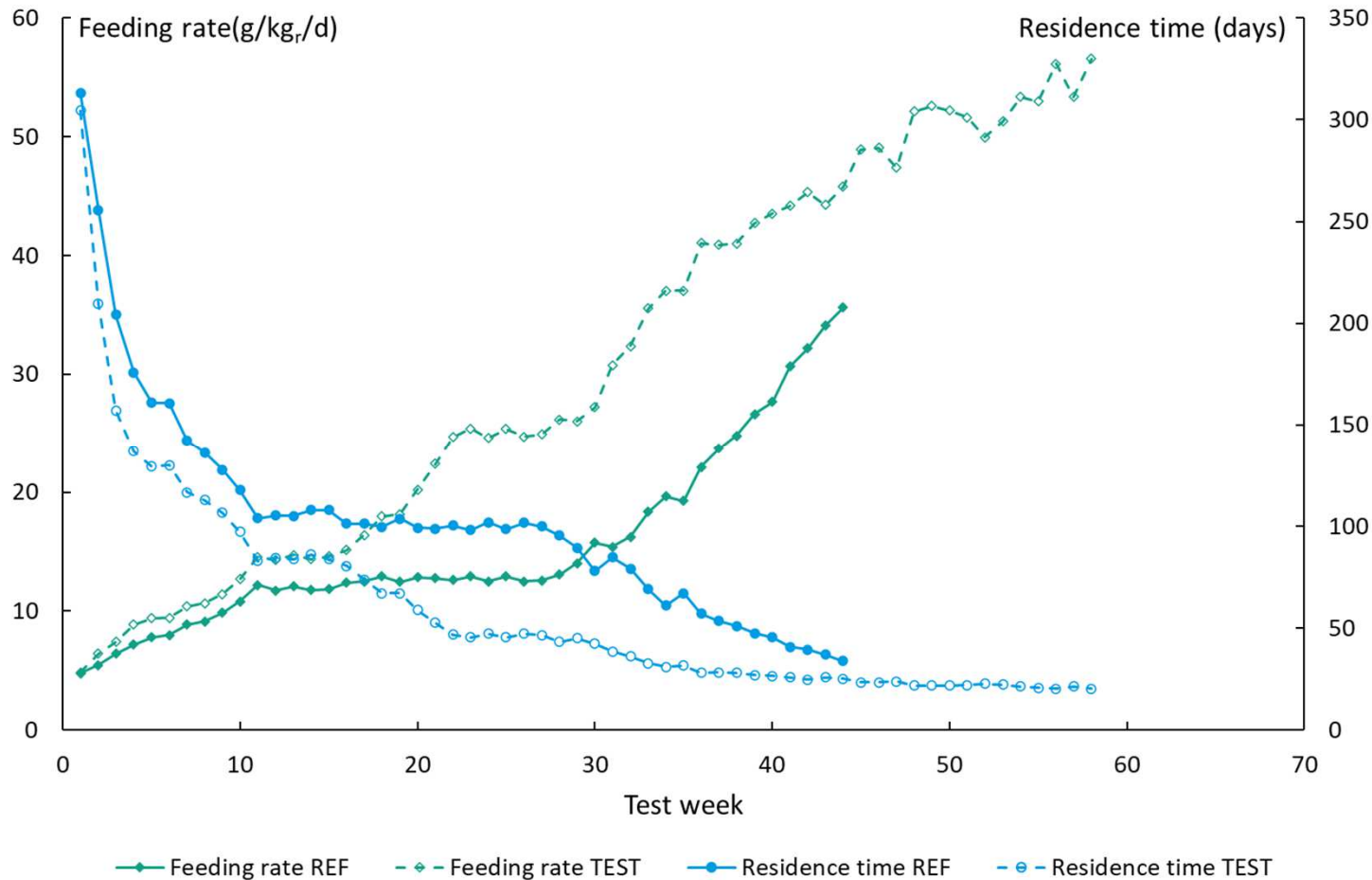


Week 22-48



Week 48+

# Using residual biomass for energy recovery → Continuous AD of AgriMax residues as co-substrates (42°C)

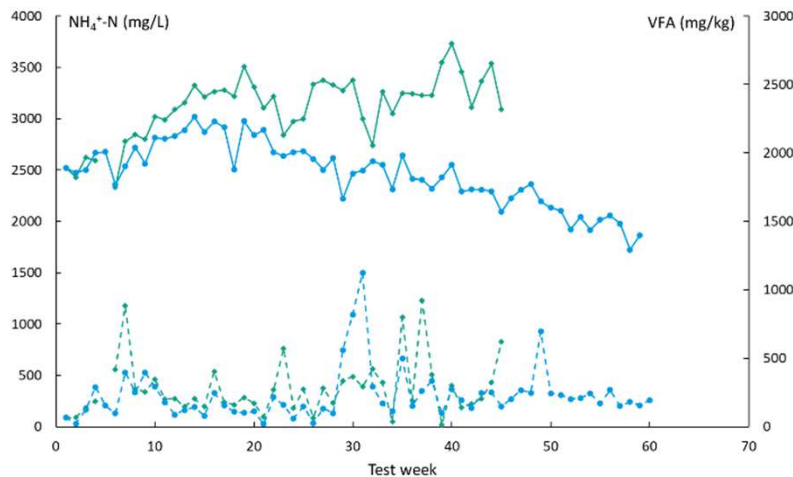
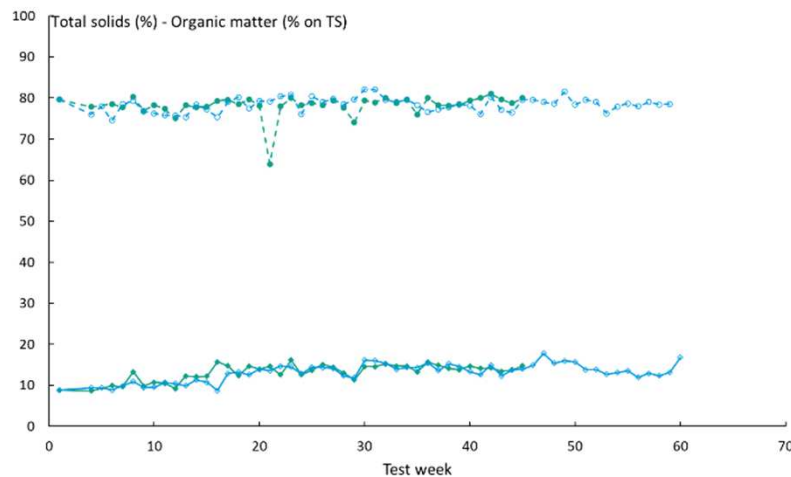
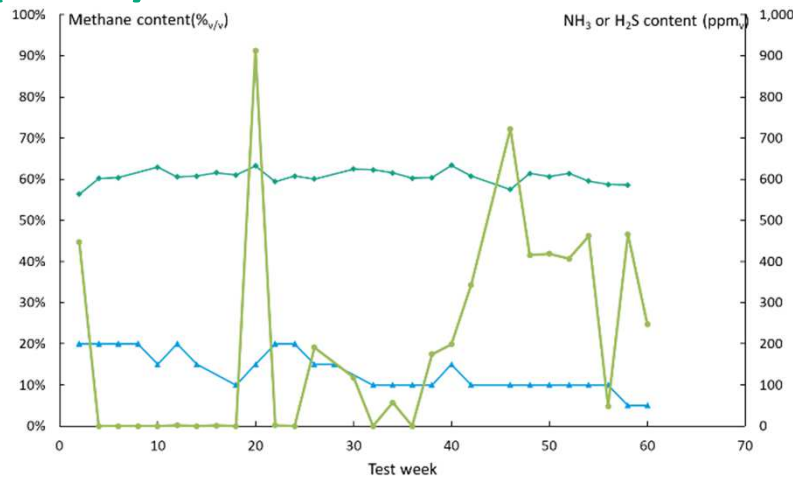
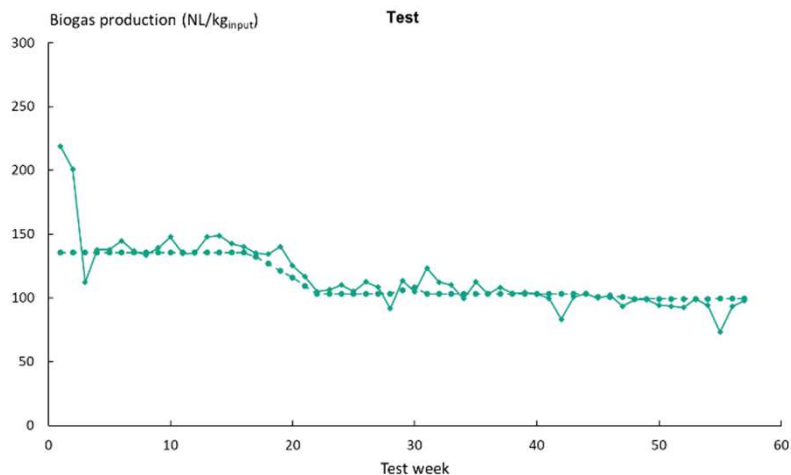


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# Using residual biomass for energy recovery → Continuous AD of AgriMax residues as co-substrates (42°C)



— Total solids REF    - - Organic matter REF    — Total solids TEST    - - Organic matter TEST

— NH4 REF    — NH4 TEST    - - VFA REF    - - VFA TEST



Loading rate of 5,0 NL/kg/d



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# Using residual biomass for energy recovery: conclusions

AgriMax tomato based residues suitable for AD at 52°C: high loading rate, stable process

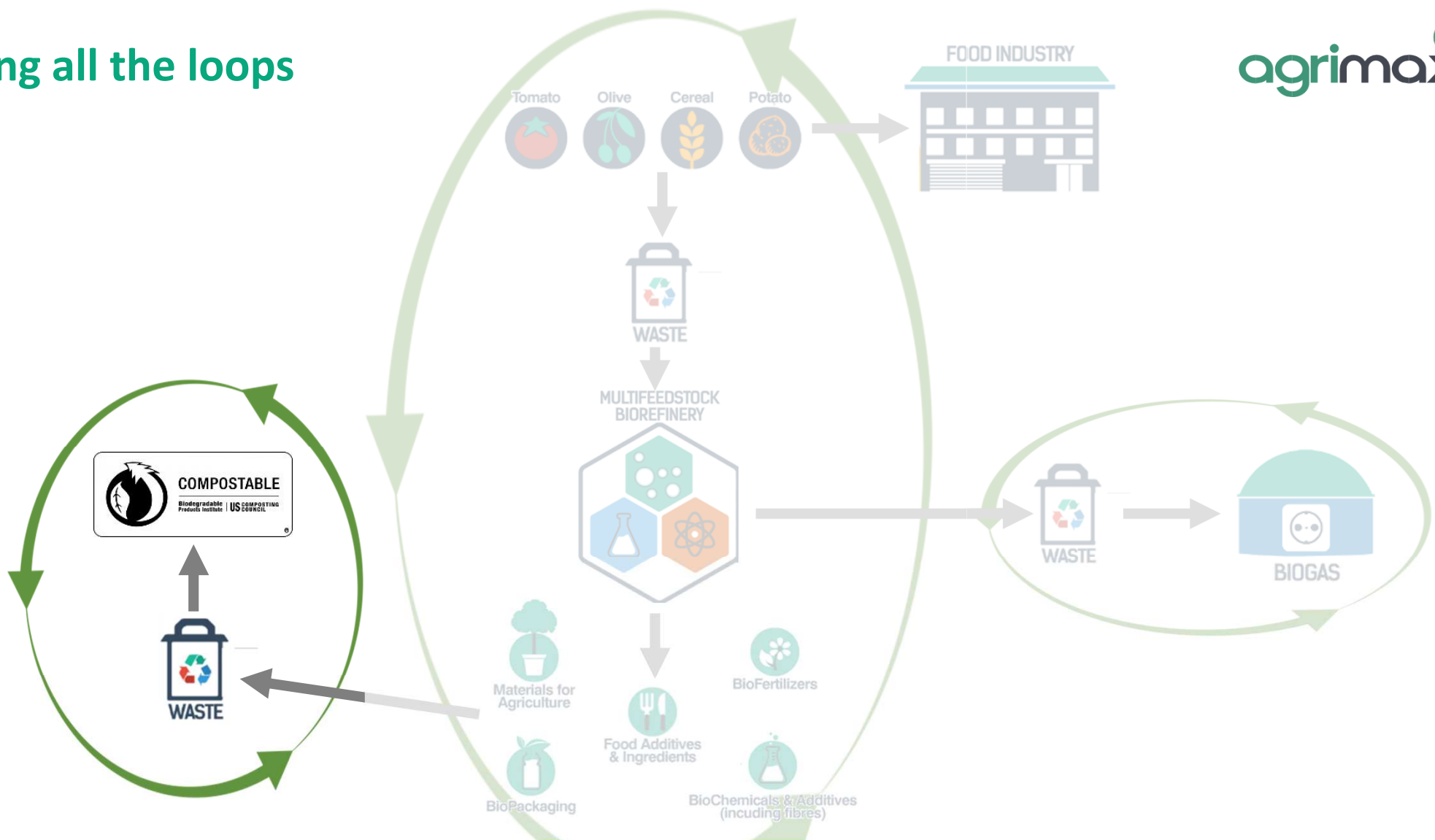
AgriMax wheat bran based residues not suitable for AD at 52°C: build-up of VFAs

Combined AgriMax tomato and wheat bran based residues suitable for AD at 52°C: high loading rate, stable process

Co-digestion of Agrimax tomato and wheat bran based residues in existing CHIESA AD plant feasible: high loading rate under stable conditions possible

- replace part of current input with AgriMax residues      OR
- increase current input with AgriMax residues → higher biogas production

# Closing all the loops



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# Organic recycling: What?

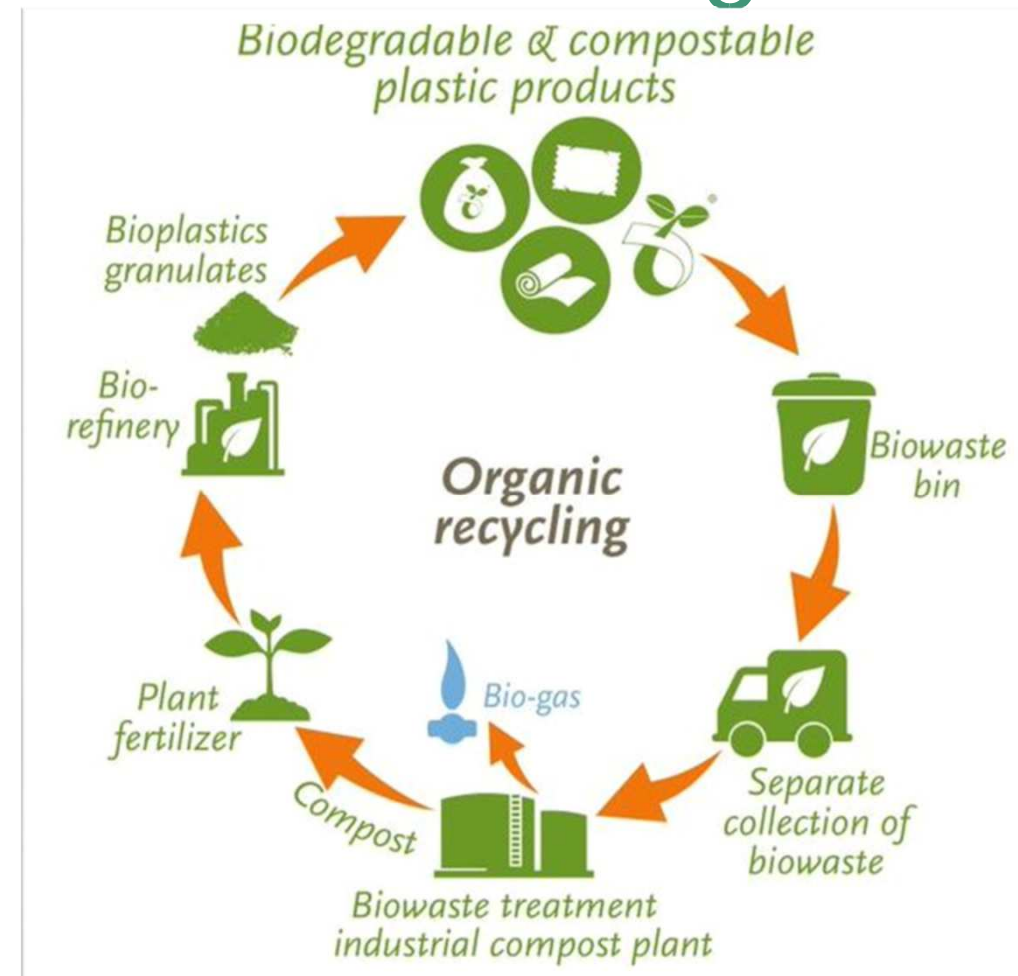
EU Packaging and Packaging Waste Directive 94/62/EC (amended in 2005/20/EC):

*“the aerobic treatment (industrial composting) or anaerobic treatment (biogasification) of packaging waste”*

Industrial composting and anaerobic digestion are biological processes for the treatment of organic waste with the conversion into compost and optionally biogas (anaerobic digestion)

Organic material = fruit, vegetables, meat, but also man-made products such as plastics, nylon, paper, bagasse materials,...

BUT not all these organic man-made products are suitable for organic recycling => Standard with test methods and requirements: EN 13432

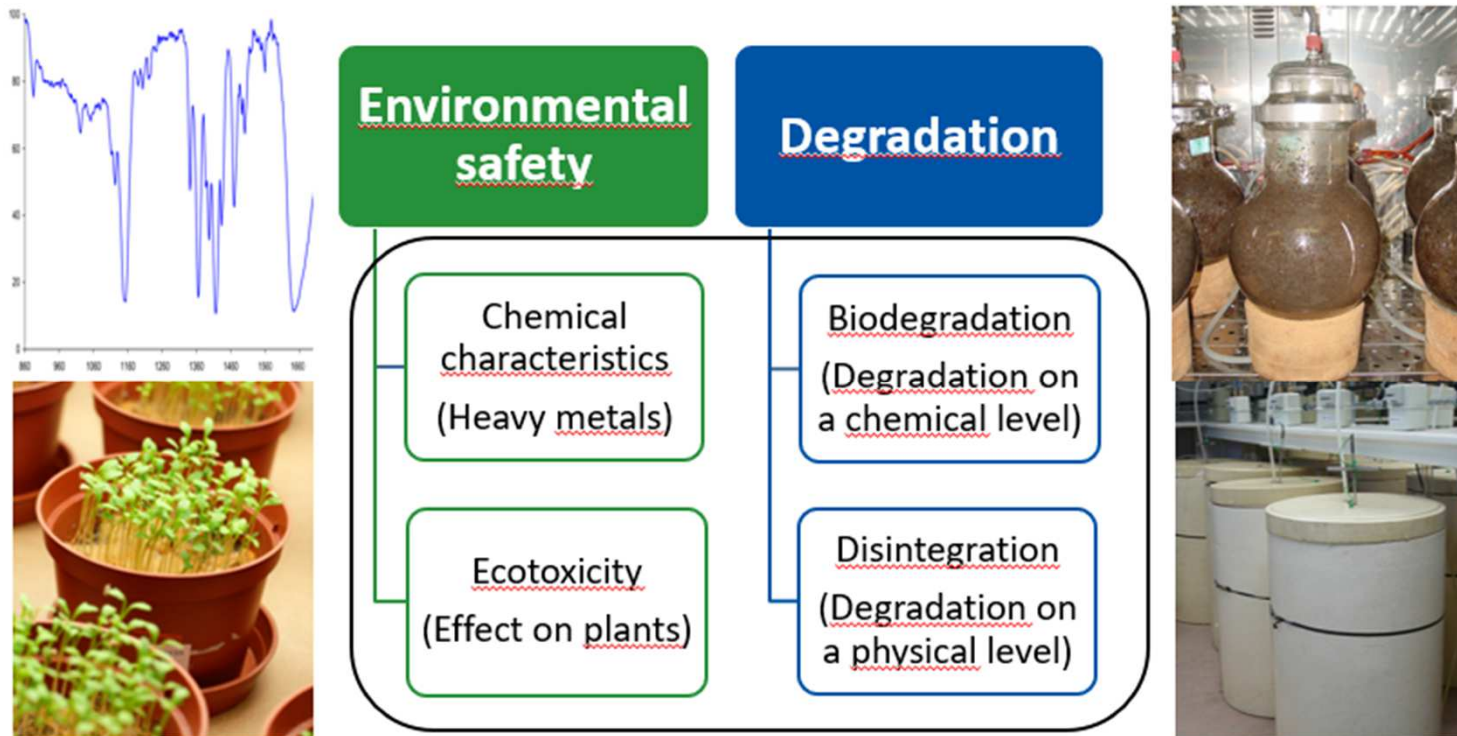


Source: European Bioplastics

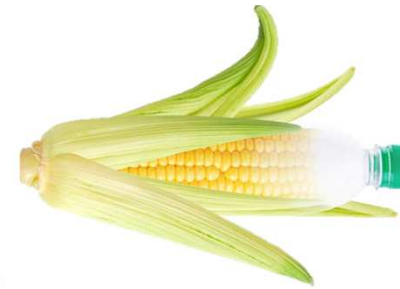


# Organic recycling: EN 13432

Harmonized European norm: sets requirements for industrial compostable products



# Organic recycling: AGRIMAX

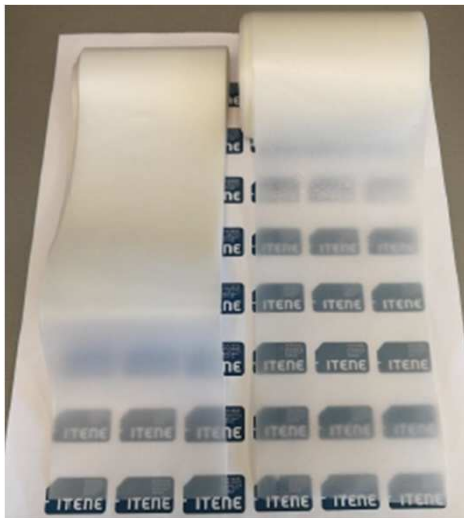


Biobased products developed and tested in line with EN 13432

Biobased = derived from biomass, such as plants, trees or animals (↔ fossil based (petrochemicals))

Biobased ≠ biodegradable (fossil based ≠ non-biodegradable)

AGRIMAX: Food packaging, mulch films, plant pots: industrially compostable



# Organic recycling: AGRIMAX plant pot

(thickness: 0.10 mm (bottom & sidewall) and 0.15 mm (edge))

## Biodegradation in controlled composting (58°C; ISO 14855)

Biodegradation = microbial conversion of organic carbon of test material into CO<sub>2</sub> and biomass

Maximum duration: 180 days

Pass level: 90% absolute or relative biodegradation: **OK**

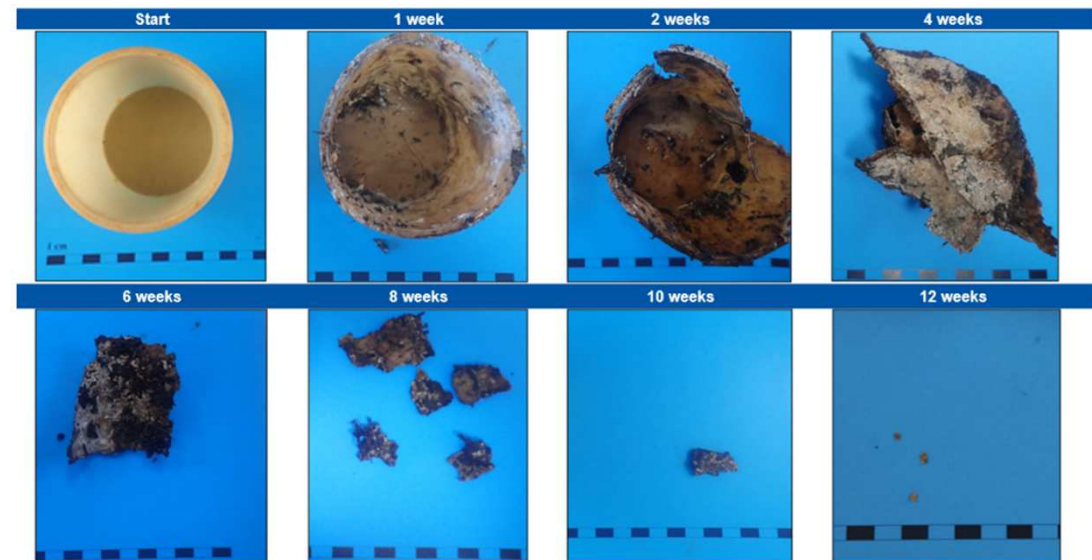
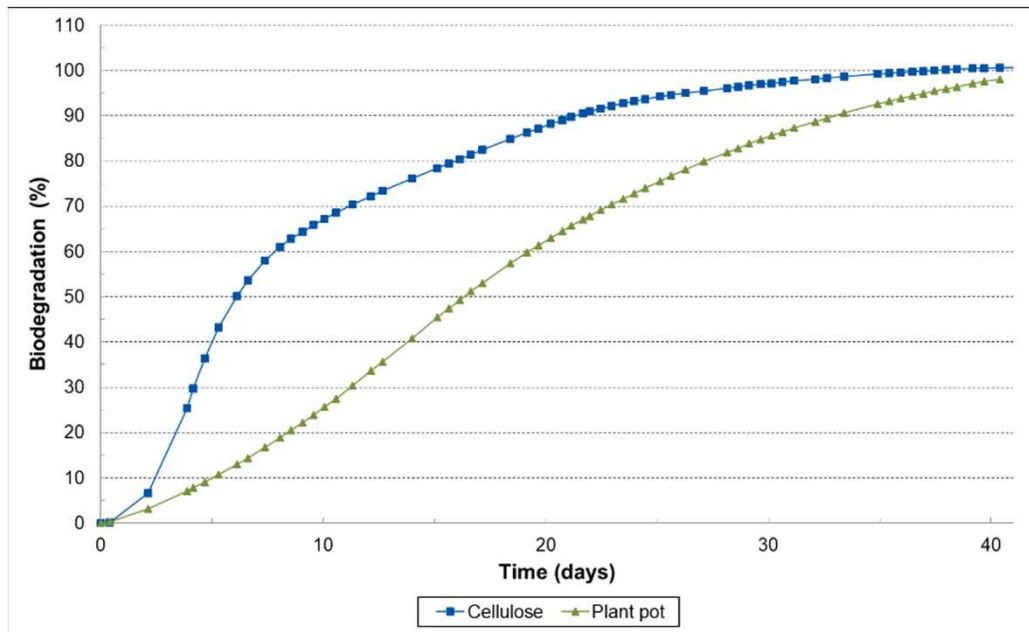
## Disintegration in pilot-scale composting (ISO 16929)

Disintegration = physically falling apart of a material

Important characteristic: thickness

Maximum duration: 12 weeks

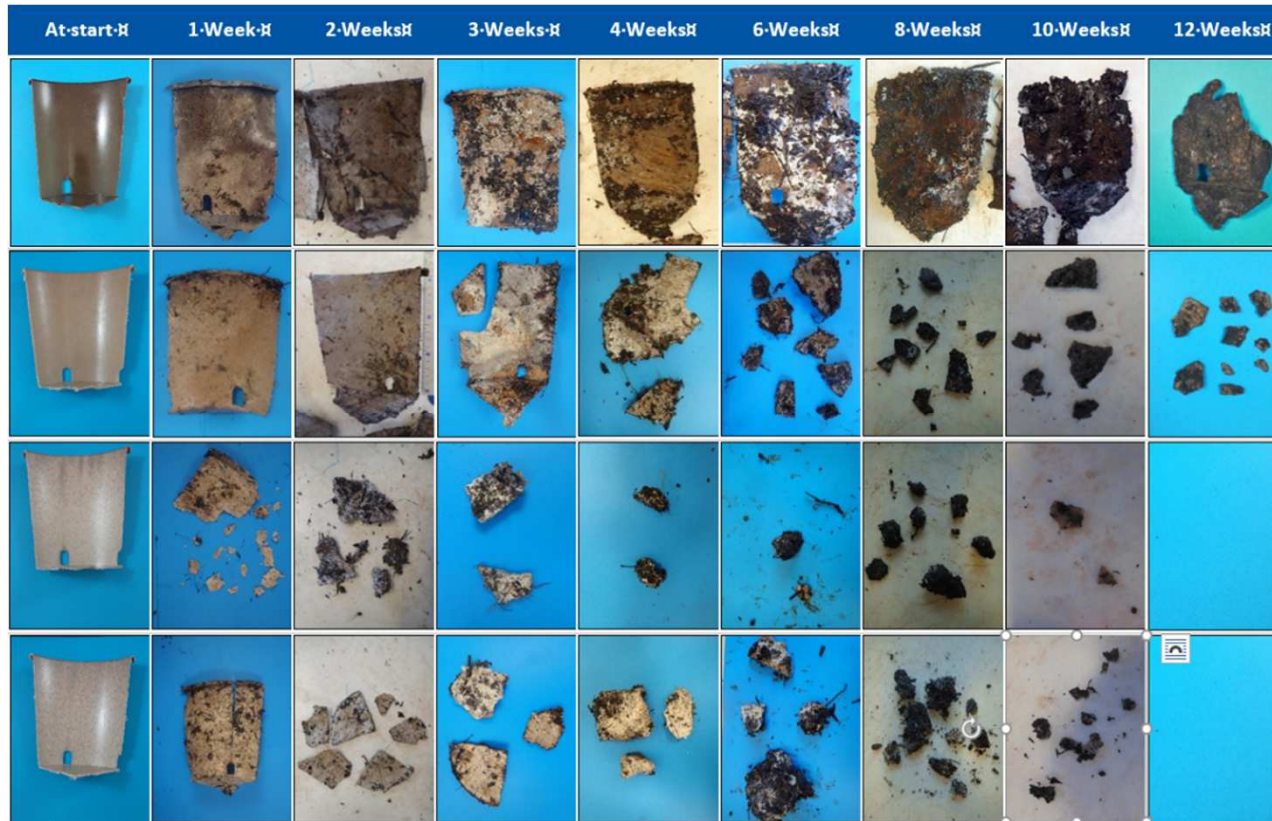
Pass level: < 10% material remains present in > 2 mm fraction: **OK**



# Disintegration (ISO 16929, pilot-scale composting)

Influenced by thickness, but also by composition

Degradation of 4 different compositions for plant pots. All basic compounds are certified for industrial compostability (EN 13423). Only 2 passed the 90% disintegration requirement.



# Questions

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