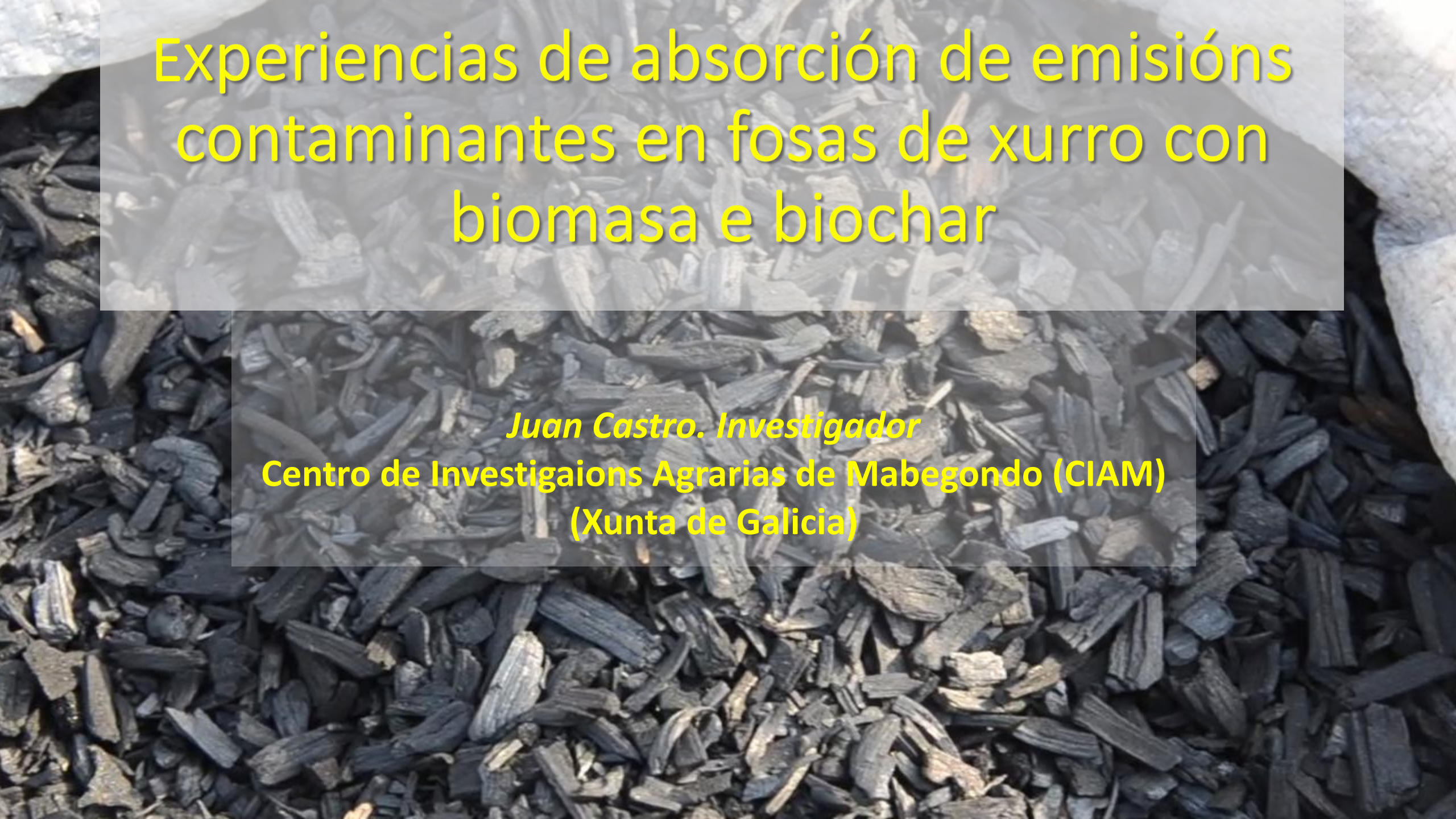


The background of the slide is a close-up photograph of a mixture of wood chips and biochar. The wood chips are light-colored and irregularly shaped, while the biochar is dark, almost black, and also irregular. They are piled together, creating a textured surface.

# Experiencias de absorción de emisiones contaminantes en fosas de xurro con biomasa e biochar

*Juan Castro. Investigador*  
Centro de Investigaions Agrarias de Mabegondo (CIAM)  
(Xunta de Galicia)

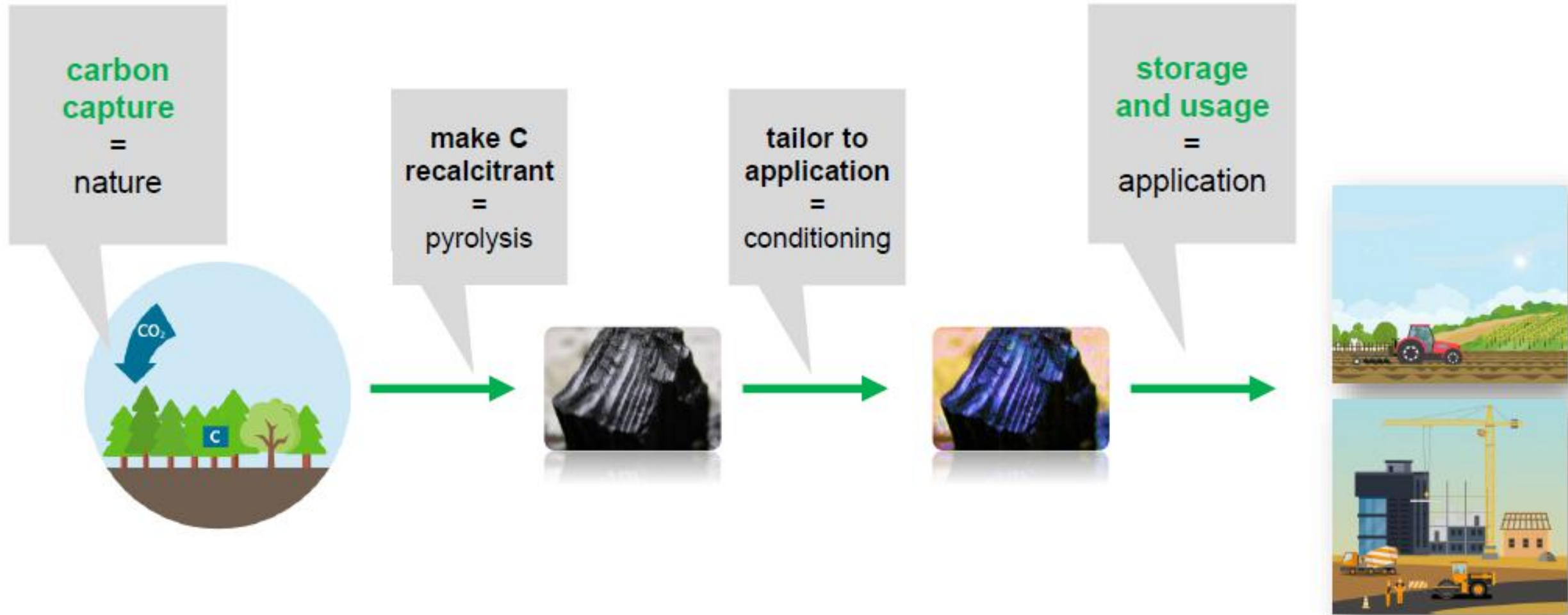
# What is biochar?

*Biochar is obtained from biomass by pyrolysis*



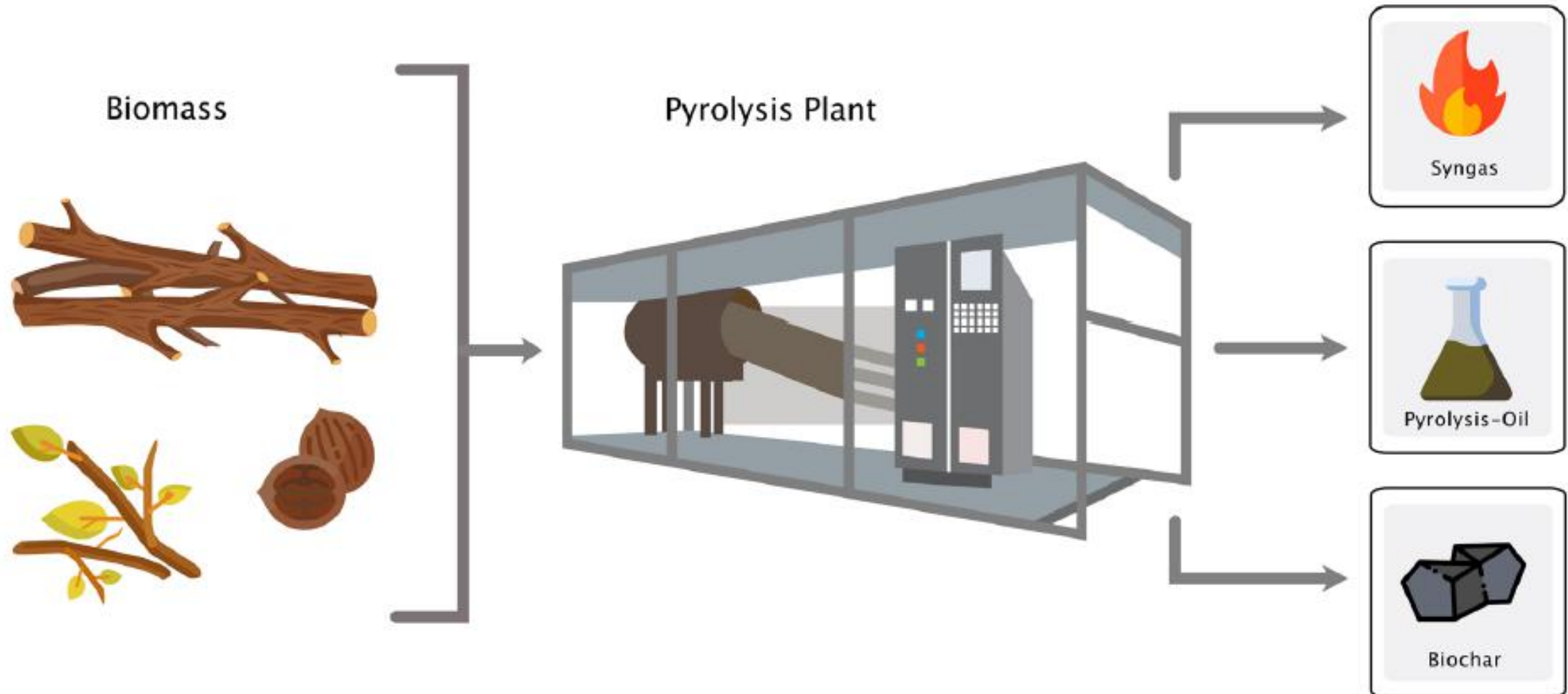
# Biochar: Capturing carbon, using and storing it

Easy to produce, harmless to the environment, easy to transport, with a broad range of applications



# Material flows in biomass pyrolysis

The process management determines the allocation to the three possible end products



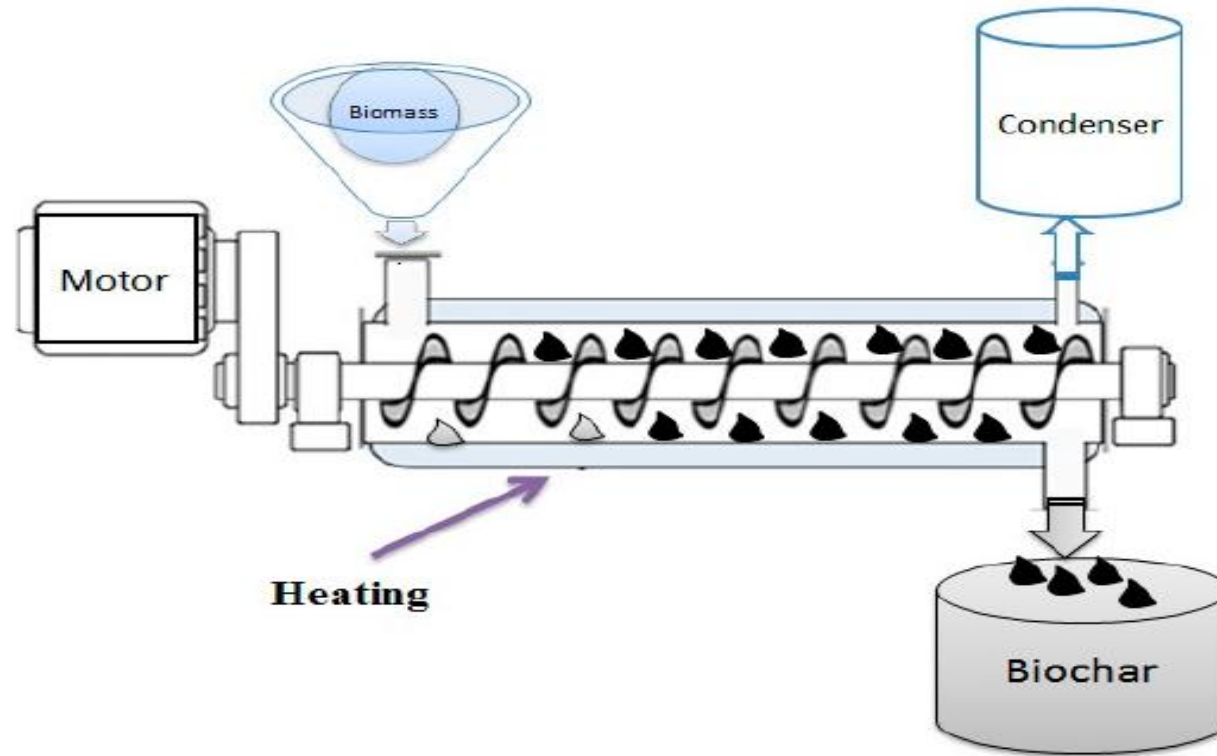


**Table 1.** Average ranges for the process conditions in biochar production technologies most used at present, including slow and fast pyrolysis, gasification, and torrefaction, and yield of the main products for each technology [1,50,74].

|                              | Slow Pyrolysis | Fast Pyrolysis | Gasification | Torrefaction |
|------------------------------|----------------|----------------|--------------|--------------|
| Temperature (°C)             | 300–800        | 350–1000       | 700–100      | 200–300      |
| Heating rate (°C/s)          | 0.1–10         | 10–200         | 5–100        |              |
| Feedstock particle size (mm) | 5–50           | 2              | 0.2–10       | 0.2          |
| Solid residence time         | Hours to days  | 0.5–10 s       | >1 h         | >1 h         |
| Biochar yield (%)            | 35–45          | 5–20           | 5            | 60–80        |
| Bio-oil yield (%)            | 25–35          | 50–60          | 10           | 5            |
| Syngas yield (%)             | 20–30          | 10–20          | 85           | 5–10         |

Due to differences in production temperature,  
production method, and feedstock:

- Surface area
- Ash content
- Cation exchange capacity
- Water holding capacity
- pH
- H/C ratio
- C/N ratio
- Porosity
- Elemental composition



# The European Biochar Certificate (EBC)

Standards and regulations are key for large-scale roll-out

deutsch

EBC - European Biochar Certification

Home EBC Guidelines C-Sink EBC Producer Laboratories Register your company login

## THE EUROPEAN BIOCHAR CERTIFICATE (EBC)

The EBC was developed to limit the risks of biochar usages to the best of our scientific knowledge and to help the users and producers of biochar to prevent or at least to reduce any hazard for the health and for the environment while producing and using biochar.

For thousands of years, charcoal has been one of civilisation's basic materials. By far the most common use of charcoal was for cooking, for heating and for smouldering when producing metal tools. However, for centuries charcoal and biochar have also been used for conditioning soils, or as litter (bedding materials, as medicine and also as a feed additive. Over the course of the last century most of this traditional knowledge has been lost yet is being rediscovered since 2010.

Thanks to wide-ranging multidisciplinary research and field trials, the understanding of the biological and physico-chemical processes involved in the production and use of biochar has made great progress. A significant increase in the agricultural use of biochar has already been recorded since 2015. From 2020 onwards, a further acceleration in both agricultural and industrial use of biochar is expected. Agricultural applications range from soil conditioners, composting additives and carriers for fertilisers to manure treatment and stable bedding, silage additives and feed additives. Industrial applications are particularly relevant to the construction, plastics, paper and textile industries.

- EBC Classes
  - EBC Agro, AgroBio, Feed
  - EBC Material
  - **EBC Sink**
- Production
  - Permitted feedstock
  - Energy efficient production
  - Calculation of carbon sink potential
- Properties
  - C-content
  - H/C, O/C
  - pH
  - heavy metals
  - PAH 16
  - ...

<https://www.european-biochar.org>

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## CHARACTERIZATION DATABASE

| SELECT                | X-AXIS           | Y-AXIS                             |
|-----------------------|------------------|------------------------------------|
| Plot Selection        |                  |                                    |
| <input type="radio"/> | Temperature (°C) | Ash content (%)                    |
| <input type="radio"/> | Temperature (°C) | C/N ratio                          |
| <input type="radio"/> | Temperature (°C) | O/C ratio                          |
| <input type="radio"/> | Temperature (°C) | Surface area (m <sup>2</sup> /g)   |
| <input type="radio"/> | Temperature (°C) | Cation exchange capacity (cmol/kg) |
| <input type="radio"/> | Temperature (°C) | pH                                 |
| <input type="radio"/> | H/C ratio        | O/C ratio                          |

|                       |                   |
|-----------------------|-------------------|
| Peer Review           |                   |
| <input type="radio"/> | Peer Reviewed     |
| <input type="radio"/> | Not Peer Reviewed |
| <input type="radio"/> | All               |

|                          |             |
|--------------------------|-------------|
| Feedstock                |             |
| <input type="checkbox"/> | Algae       |
| <input type="checkbox"/> | Corn stover |
| <input type="checkbox"/> | Grass       |
| <input type="checkbox"/> | Hull        |
| <input type="checkbox"/> | Manure      |
| <input type="checkbox"/> | Nutshell    |
| <input type="checkbox"/> | Pomace      |
| <input type="checkbox"/> | Sludge      |
| <input type="checkbox"/> | Wood        |
| <input type="checkbox"/> | Soft Wood   |
| <input type="checkbox"/> | Hard Wood   |
| <input type="checkbox"/> | ALL         |

Submit

After submitting your request the database will generate a corresponding plot. Your plot may take a moment to appear. If you receive an error ("Your plot selection returned an empty data set") this results from a lack of data corresponding to one of your specific choices. If this happens please adjust your plot criteria and resubmit.

UC DAVIS  
BIOCHAR  
DATABASE

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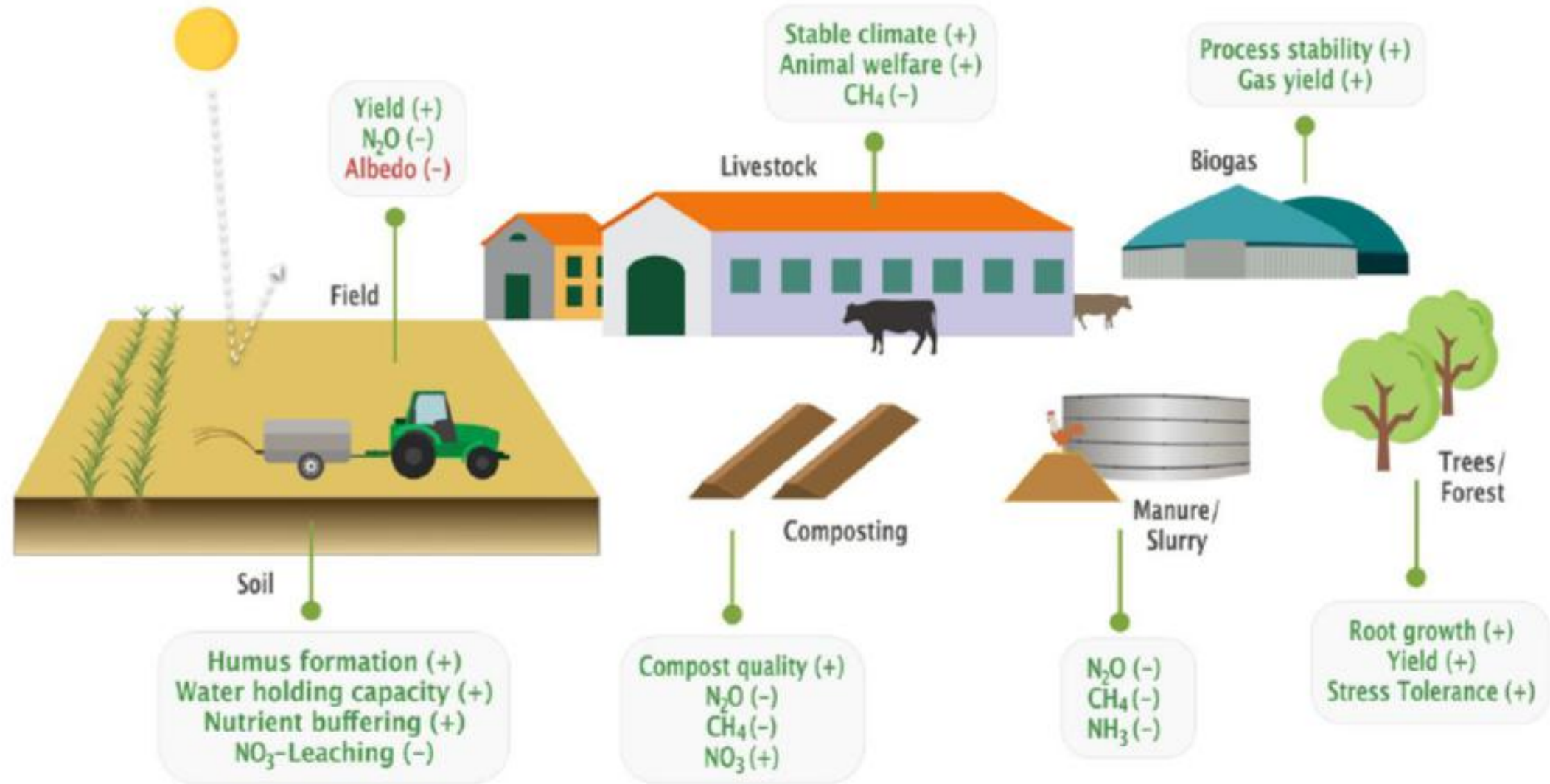
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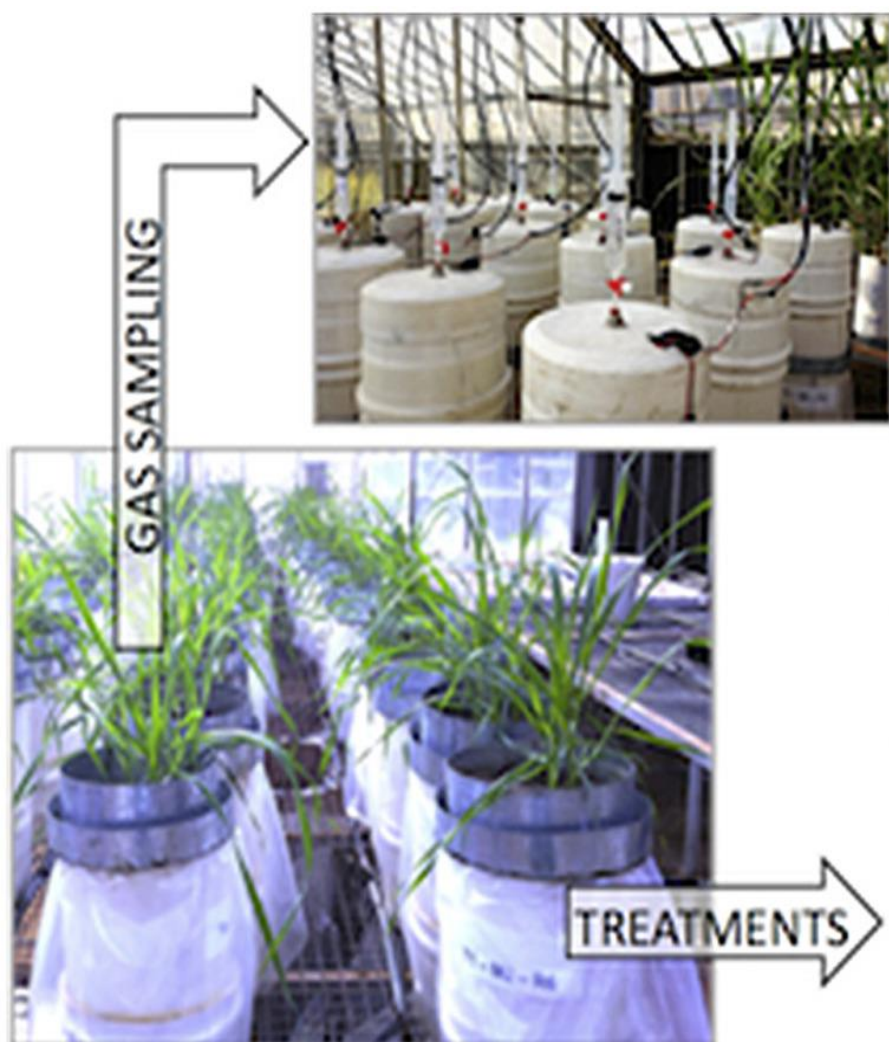
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UCD SOIL CHEMISTRY

# Application benefits of biochar

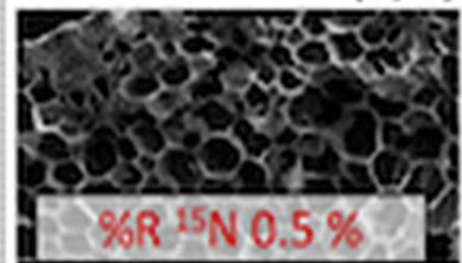
In the systems barn, manure/slurry, biogas plant, composting, field, trees/forest and soil





$\text{N}_2\text{O}$  emissions: **71 % reduction** w/ biochar amendment  
 $^{15}\text{N}$  gaseous losses: amended ~ unamended (**estimated in 38 %**)

Biochar 0.4–1.9 % (w/w)



SOIL

PLANT



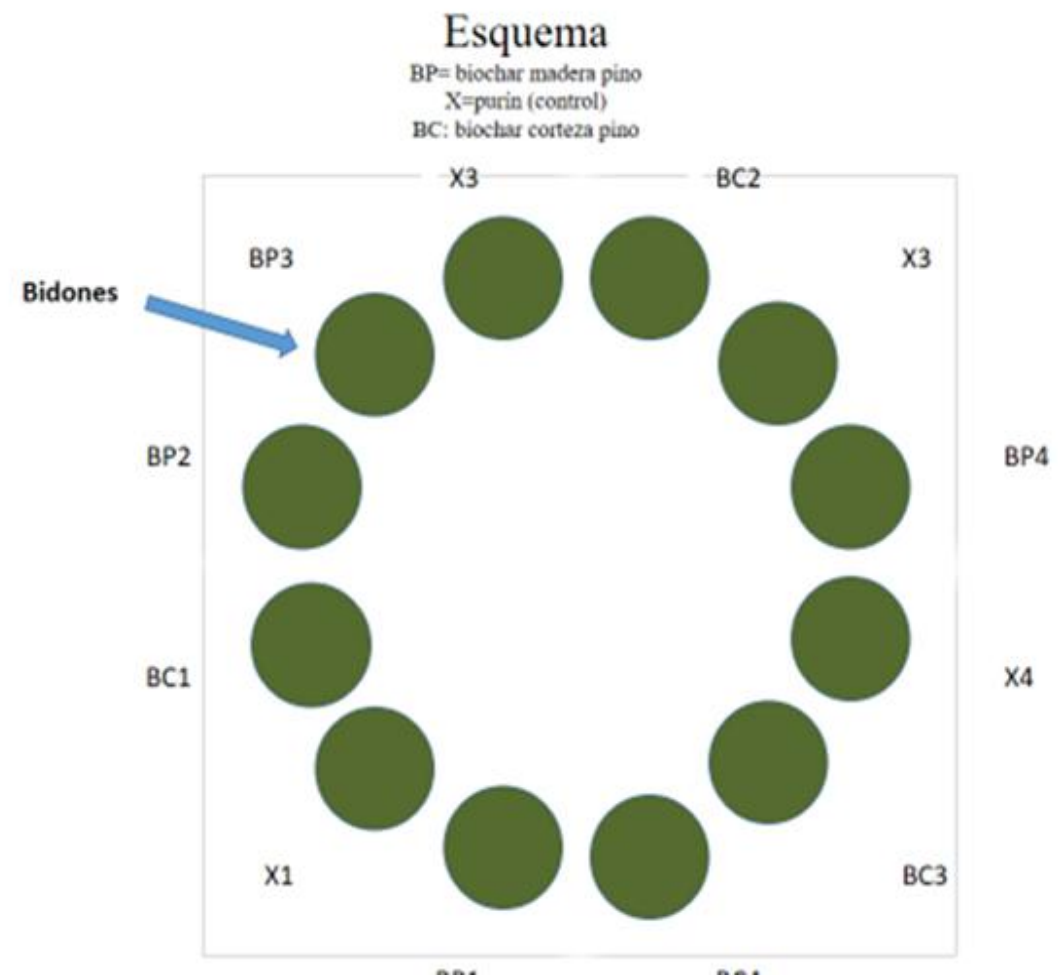
pH  
 available P  
 exchangeable  $\text{K}^+$   
 $\text{NO}_3^-$   
 %R  $^{15}\text{N}$  in soil: **13.5 %**

grain yield  
 %R  $^{15}\text{N}$  in grains: **25.2 %**  
 shoot dry weight  
 no effects on %R  $^{15}\text{N}$  in shoot (**20.4 %**)  
 no effects on root dry weight  
 no effects on %R  $^{15}\text{N}$  in roots (**2 %**)

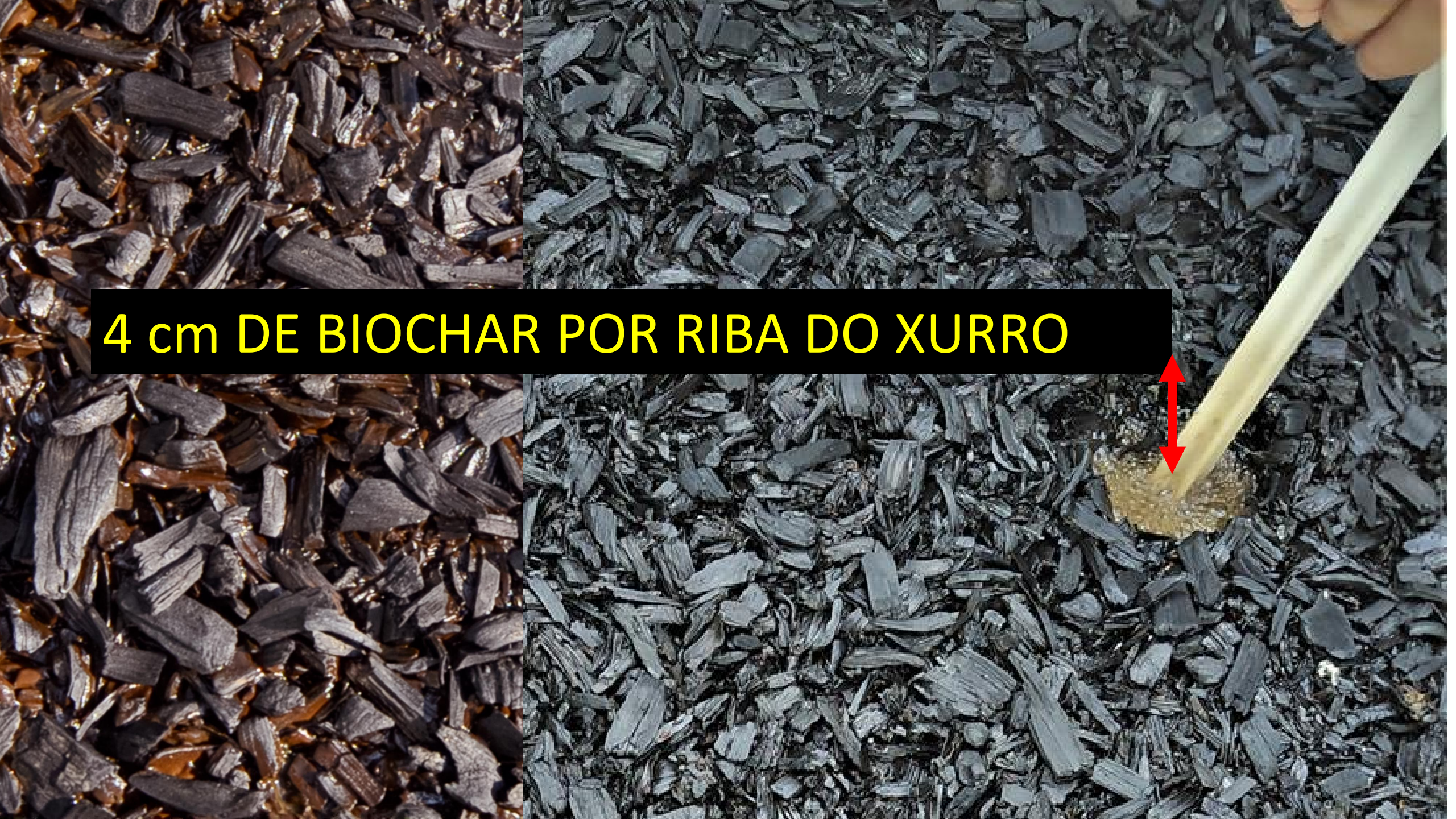
# METODOLOXÍA: EMISIÓNS DE AMONÍACO

Avaliáronse 3 tratamentos de xurro diferentes,

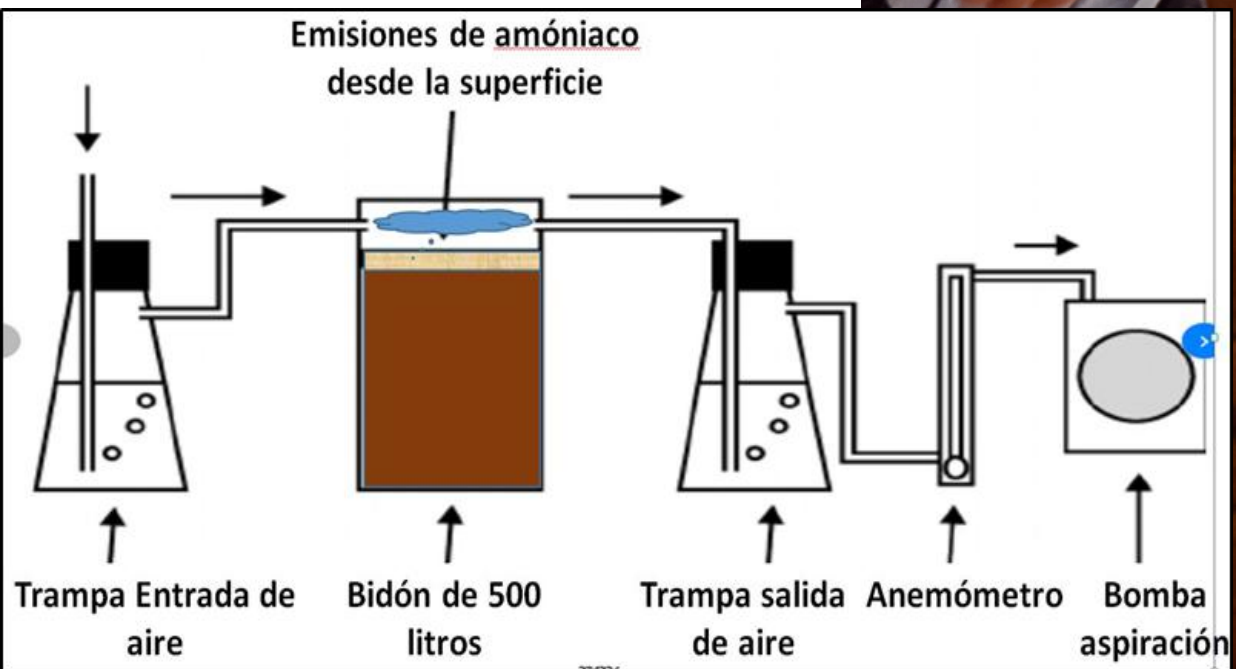
- 1. BP: xurro con **biochar de astela** de madeira de piñeiro;
- 2. BC: xurro con **biochar de cortiza** de piñeiro;
- 3. X: **Xurro** sen biochar
- Por cada tratamento realizáronse catro repeticións (12 medicións en total).
- Durante os meses de abril e maio de 2021, fixéronse as mostraxes mediante 8 horas de aspiración dos gases dos bidóns que se recolleron nas trampas de acedo sulfúrico en continuo para precipitar o sulfato amónico para logo facer a determinación do Nitróxeno no laboratorio do CIAM.





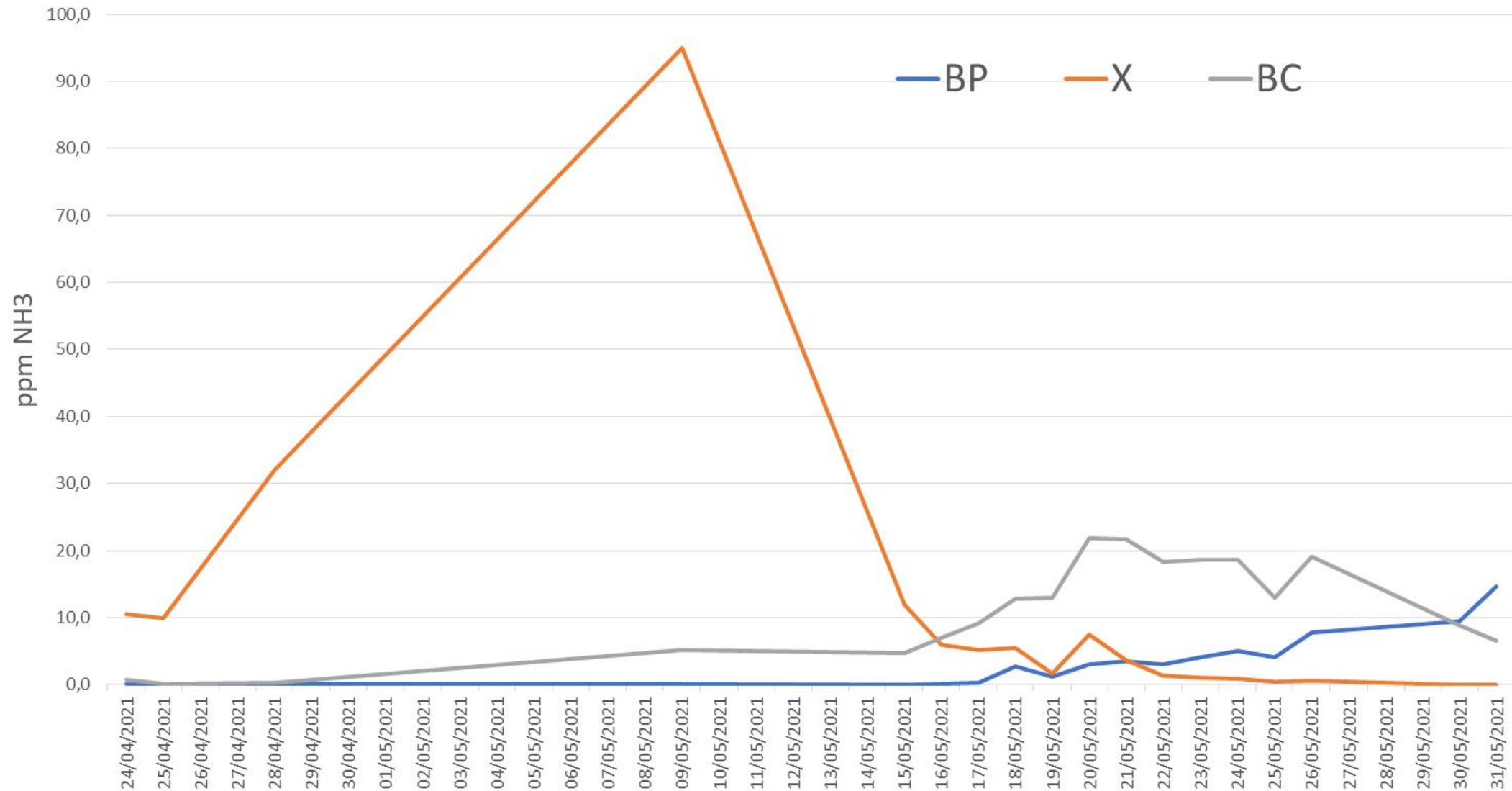


4 cm DE BIOCHAR POR RIBA DO XURRO

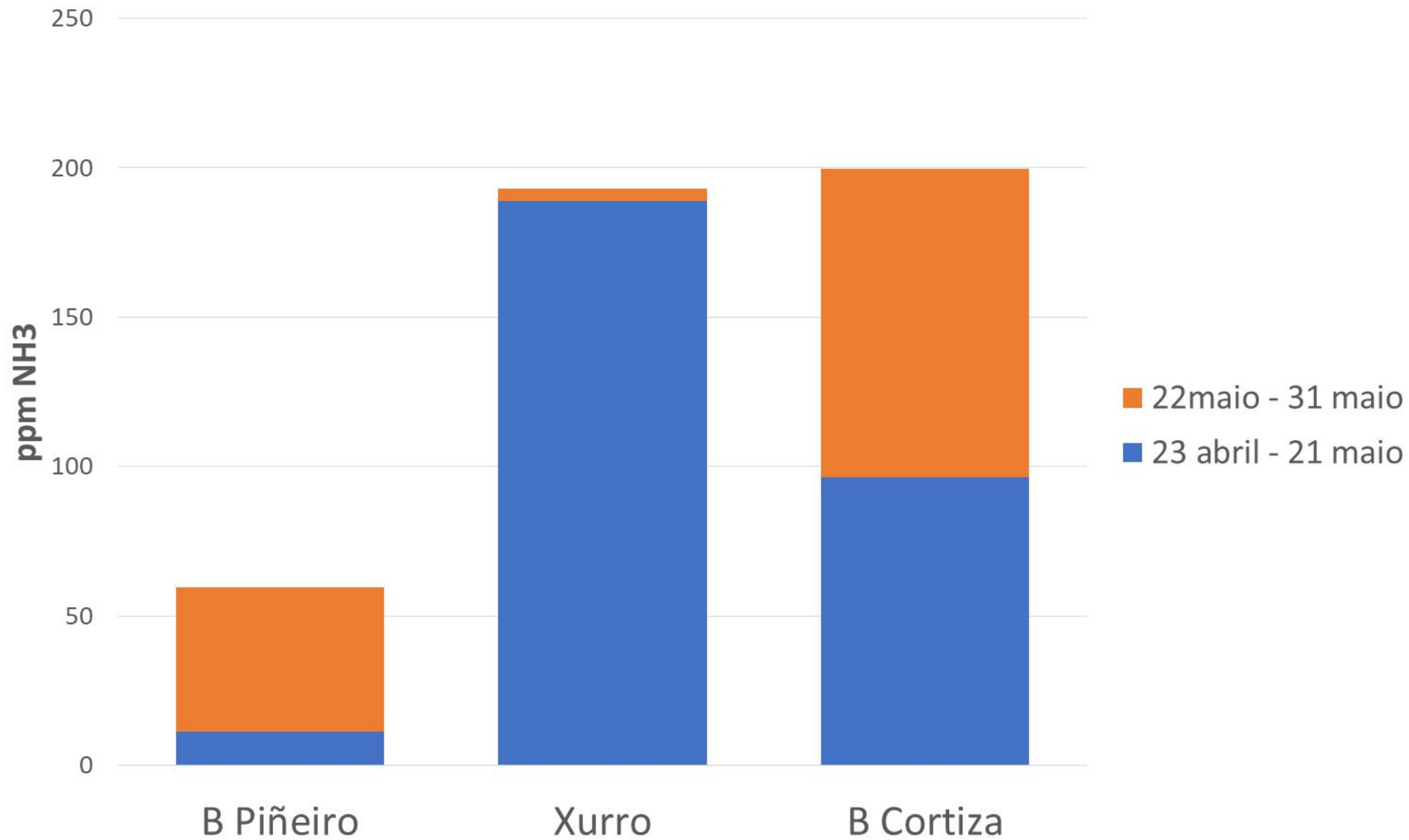


# Emisiões de amoníaco (medias por tratamento)

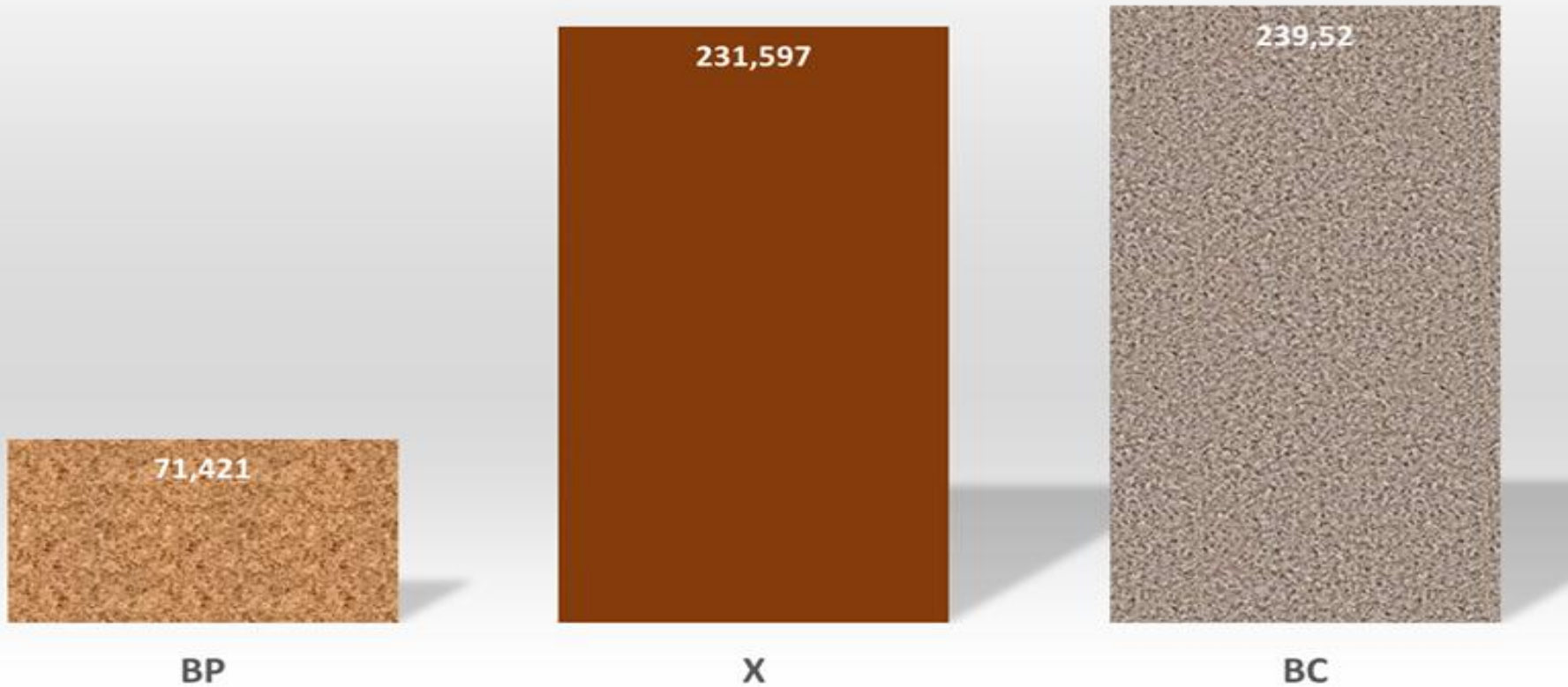
23 de abril - 31 de maio



## Emisións totais de NH3



## Emisiones totales de amoníaco al final del muestreo (ppm NH<sub>3</sub>)



Os resultados mostran que o biochar de astela de de piñeiro **reduciu as emisións de amoníaco en case un 71% sobre o xurro sen tratar**, mentres que o biochar de cortiza de piñeiro non mostrou ningunha redución das emisións.

# MEDICIÓN DE METANO

- Utilizouse un espectro fotómetro de absorción LaserMethane mini (LMm) que emite determinadas lonxitudes de onda e analiza a luz reflectida para determinar a cantidade de metano absorbida.
- O volume de gas medido exprésase mediante a densidade da columna de metano (ppm-m): densidade de metano (ppm) multiplicada polo espesor (m).
- Este equipo de medición supuxo unha mellora importante das medicións ao poder visualizarse en tempo real permitindo a transmisión dos datos por Bluetooth

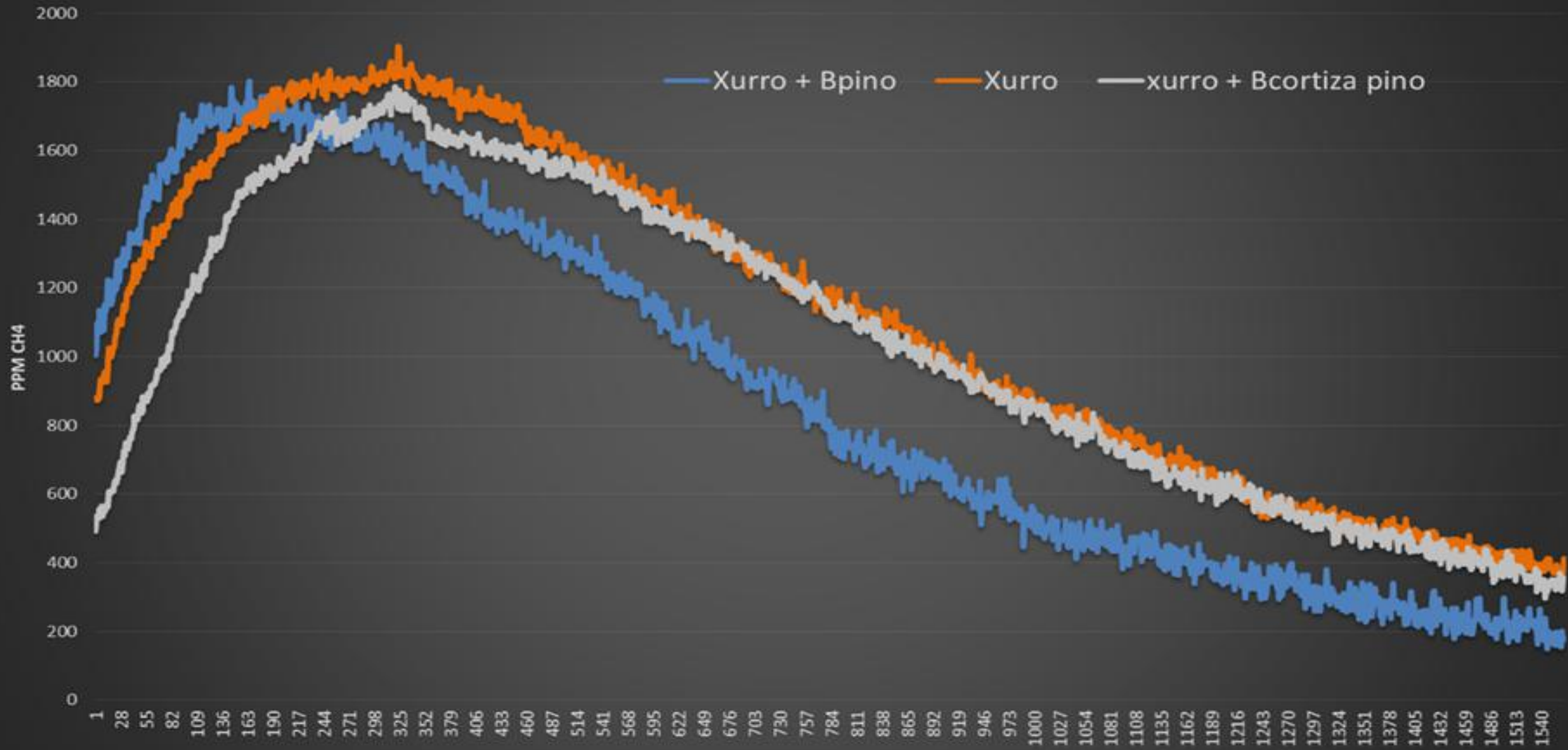


**LaserMethane mini (LMm)**

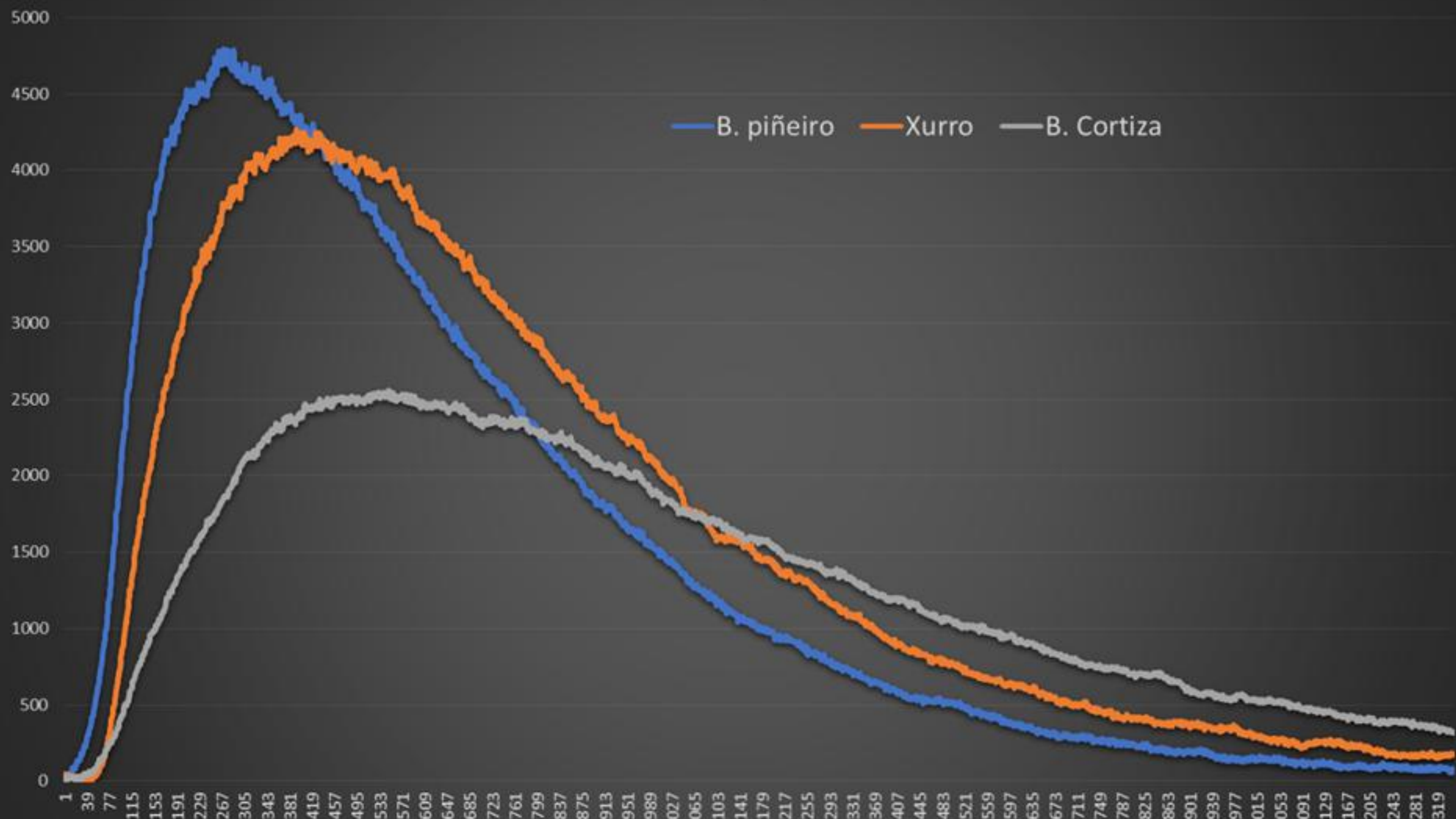


# Emisións de metano (medias 4 repeticións)

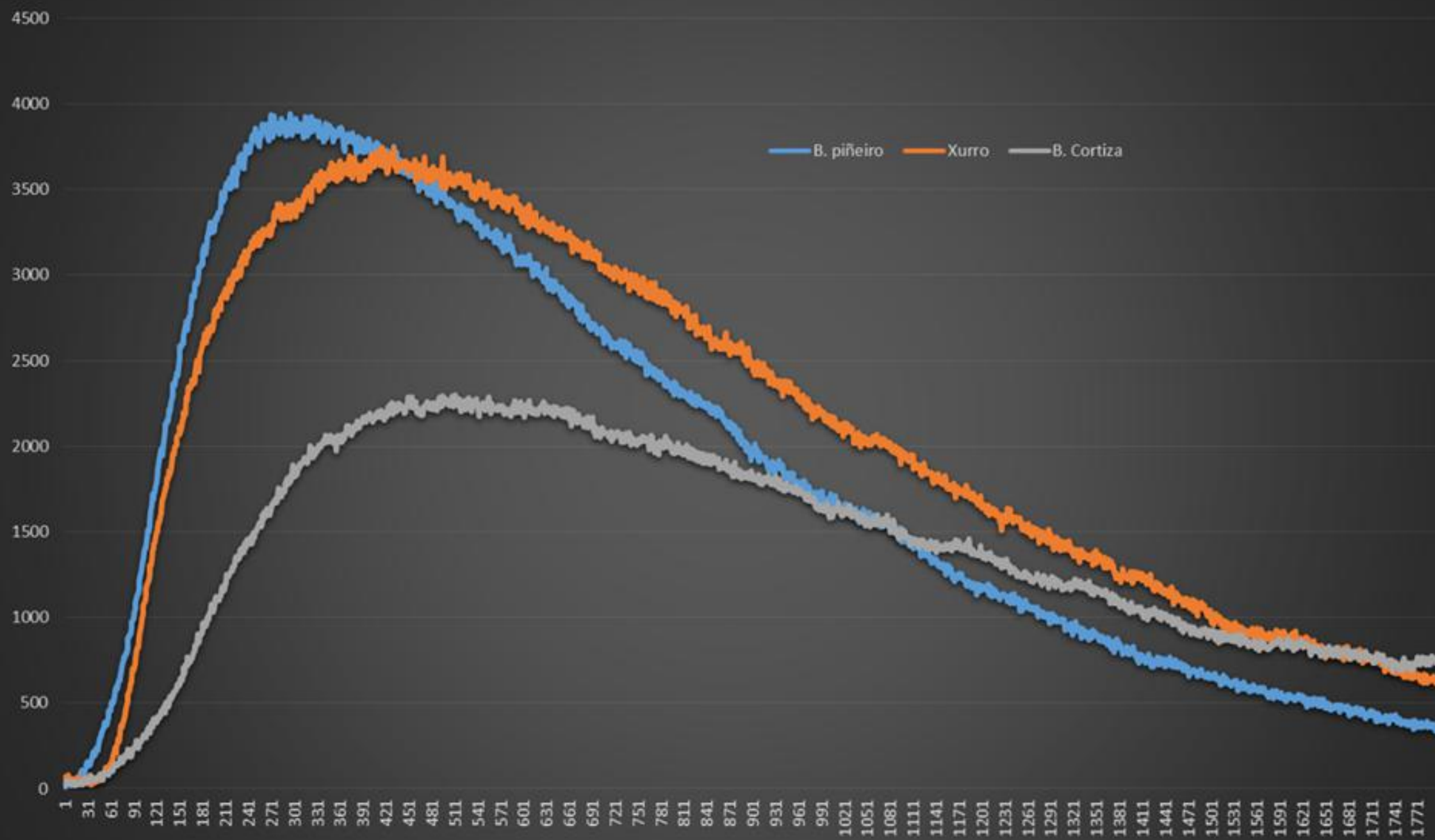
26 de maio



26 de agosto



6 de setembro



| Data de muestreo                   | Biochar Piñeiro    | Xurro      | Biochar Cortiza    |
|------------------------------------|--------------------|------------|--------------------|
| 26-may                             | 1398513,25         | 1754750,25 | 1630509,5          |
| 16-jul                             | 4622814,75         | 6338008,25 | 6704522,75         |
| 26-jul                             | 4306644,25         | 4432690,75 | 4062240,25         |
| 09-ago                             | 2414801,75         | 2804942,75 | 2484196,5          |
| 13-ago                             | 3669755,75         | 4309683    | 3742272,75         |
| 26-ago                             | 3651014,75         | 3918899    | 3158954,5          |
| 06-sep                             | 3372102,25         | 3749187,25 | 3088426            |
| 21-sep                             | 876857,5           | 1480972,75 | 772693             |
| 27-sep                             | 1281157,75         | 1724332,25 | 869850,333         |
| Total emisións de CH4              | 25593662           | 30513466,3 | 26513665,6         |
| <b>% <i>redución CH4/xurro</i></b> | <b><i>16,1</i></b> |            | <b><i>13,1</i></b> |

Nas emisións de metano medidas no período do 26 de maio ao 27 de setembro, houbo unha **redución dun 16,1 e un 13,1% para os tratamentos con biochar de astela de madeira e de cortiza de piñeiro respectivamente.**

# CONCLUSIÓN

- o biochar de madeira de piñeiro foi o que mellor resultados deu tendo en conta tanto a redución de emisións de amoníaco (70,8%), como nas de metano (16.1%).
- O biochar ten un gran potencial para a redución das emisións na fosa de xurro, sobre todo de amoníaco, polo que ademais de diminuír a contaminación atmosférica, permitiría un maior aproveitamento do nitróxeno, reducindo os costes do abono mais caro, e máis contaminante en canto as emisións indirectas de CO<sub>2</sub>, derivadas da súa fabricación industrial



Moitas gracias