



Reducing mineral fertilisers  
and chemicals use in  
agriculture  
by recycling treated  
organic waste as compost  
and bio-char products.



## **European Community BioChar - EU Fertilizer Regulation**

possible inclusion of a Biochar as fertilizer and/or additive into the new Regulation

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**<http://www.refertil.info>**

**<http://www.agrocarbon.com>**

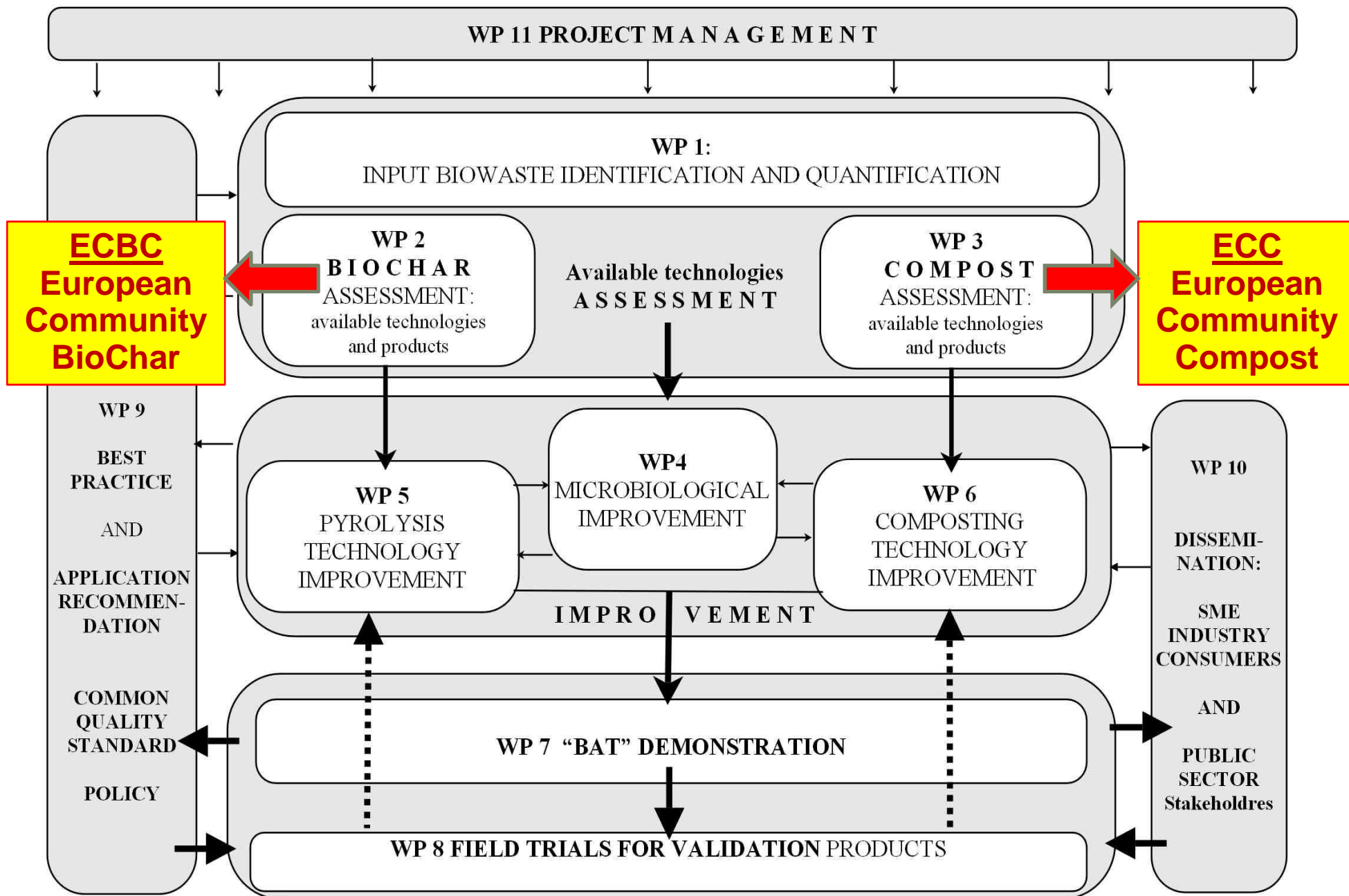
**Biochar for high efficient bio-waste resource utilization**

# REFERTIL “ECBC” European Community BioChar

- **The REFERTIL** (FP7 2011-2015) project is an applied science & technology programme for policy support to include the **biochar** and **compost** into the new EC Fertilizer Regulation. **Work field: from applied agronomical science & technology - into - economical and ecological full industrial scale scenario.**
- **EC Fertilizer concepts:** Wide range of organic waste streams (organic resources) to be recycled into safe products. N+P are critically important. SME oriented **low carbon economical developments and job creations** are important. **Biochar safety.**
- **Intensive farming practice and human activities have disturbed the natural cycles of the nutrients**, from which Phosphorous is the most important element. The **PHOSPHOROUS supply is already an NATIONAL SECURITY issue.**
- **BIOCHAR is proposed to be included into the new Fertilizer Regulation:**
  - **PLANT BASED BIOCHAR:** soil additive.
  - **ANIMAL BONE BASED BIOCHAR:** full value NPK-C fertilizer.
- **Biochar ECONOMY:** Greater the farm profitability, supports sustainable and low input/organic farming agriculture. **ROI return on investment < 3 years.** Economical industrial scale biochar productions are from 10,000 t/y and up.



# REFERTIL work elements



<http://www.refertil.info>



# WHAT IS - ECBC - BIOCHAR?

## **BIOCHAR MATERIAL** is:

- plant and/or animal bone biomass origin,
- stabile carbon carboniferous material,
- Authority permitted open ecological soil enhancement use,
- eco-safe carbon negative application.

## **BIOCHAR PRODUCT** is:

- a labeled and full value-chain safe product
- **with producers product responsibly guarantees,**
- meets the EU “End of Waste” criteria.

## **INPUT SUSTAINABLILITY CRITERIA:**

The feed material is:

- **not from primarily** and secondarily land use.
- **not competing with human food, animal feed, plant nutrition.**
- **Equally importantly environmental, climate protection and economical sustainable.**



# ABC - ANIMAL BONE BIOCHAR

**ABC** is:

- Food grade animal bone biomass **SAFE** origin.
- **Full value NPK-C natural fertilizer.**
- High concentrated Phosphate fertilizer.
- High  $P_2O_5$  nutrient **availability** for plants.
- **No heavy metals** (No Cadmium, No Uranium).
- **Supporting all types of cultivations**, including GMO and/or non GMO based, organic and/or low input farming.
- **Eco-safe** carbon negative application.
- **Economical** end user application.
- Developing new industrial sector with **high job creation potential.**
- Supporting **low carbon economy.**



**ECBC - European Community BioChar**

[www.refertil.info](http://www.refertil.info) - [www.agrocarbon.com](http://www.agrocarbon.com) - [biochar@3ragrocarbon.com](mailto:biochar@3ragrocarbon.com)



# Biochar and Compost product: Organic fertilizer or soil improver?

BIOCHAR	P <sub>2</sub> O <sub>5</sub>	N	K <sub>2</sub> O	CaO	NUTRIENT CONTENT
		% dm			
Animal bone charcoal	<b>28-30</b>	<0.1 (recycled N +5-6%)	0.4-0.8	<b>30-42</b>	<b>HIGH</b>
Plant Based Biochar	0.01-0.3	0.3-1	0.1-1	0.2-6	<b>LOW</b>

**If the nutrient content is low, the dose/ha is high → higher load of contaminants to the land**

COMPOST	P <sub>2</sub> O <sub>5</sub>	N	K <sub>2</sub> O	<b>LOW NUTRIENT CONTENT</b>
		% dm		
Animal manure / sewage sludge compost	3 – 4			
Green waste, kitchen/ canteen waste, garden / park waste compost, mixed municipal compost	< 1	0,5-3	0,5-3	



# REFERTIL biochars

## Plant based biochar:

- >90% w/w high carbon content plant origin
- micro and meso porous (1 nm – 50 nm) carboniferous product,
- high water holding and nutrient retention capacity and C sequestration,
- no soil fertilization effects. **Can be recognised as soil improver? YES**

## ABC: animal bone biochar:

- The input **animal bone meal** is food grade category 3 rendering by-product with economical importance, produced in large industrial scale (2-3 million t/y) which **concentrated high P content apatite** is an critically and strategically important inside EU natural and **RENEWABLE RESOURCE**.
- <20% w/w low carbon and high calcium phosphate/ apatite mineral content
- macro porous (50 nm – 63k nm)
- **Containing significant amount of nutrients.**
- **Can be recognised as organic fertiliser? YES**



# APPLICATION RATES FOR BIOCHAR PRODUCTS

- **Plant based biochar:** not fertilizer, ~90%C, micro & mesoporous structured. Effects: water retention, carbon sequestration. **2,500 - 5,000 kg/ha** – 20,000 kg/ha (economy ?)
- **Bone based biochar:** full value natural **NPK-C** biochar mineral fertilizer, ~30%  $P_2O_5$ , fully macroporous, macromolecular organic adsorber, soil optimized biochar, high CEC. Effects: PGP, water retention, carbon sequestration, biocontrol by-effect. **200 kg/ha – 1,000 kg/ha**

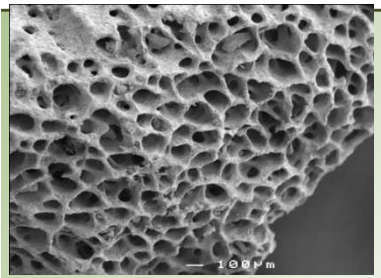


**HIGHER DOSES =  
HIGHER TOTAL VOLUME OF CONTAMINANTS**  
applied to 1 unit of soil





# The ECBC applications are successfully field test demonstrated 2005 – 2013 under different climatic and soil conditions in Germany, Italy, Spain, UK, Ireland, France, The Netherlands, Hungary, Denmark, Israel.



**ABC**  
**Animal Bone**  
**bioChar**



**Efficiency tests**

## **Commercial production tests**



The advanced 3R results are achievements of the integrated European Union top science and technology cooperation.



**Drought tolerance tests**

**The final product**  
**SAFE FOOD** for  
**affordable cost**



## BIOCHAR: complex solution to meet complex challenge

If the land needs 61.5 kg  $P_2O_5$ /ha we also add with **Plant type biochar**:

- + 304 g/ha Pb
- + 493 g/ha Ni
- + 783 g/ha Cr
- + 230 g/ha Zn

Heavy metals:  
Pb, Ni, Cr,  
Zn...

If the land needs 61.5 kg  $P_2O_5$ /ha we also add with **ABC Animal Bone BioChar**:

- + <0.1 g/ha Pb
- + 2.1 g/ha Ni
- + 0.9 g/ha Cr
- + 29.8 g/ha Zn

Biochar soil application is irrevocable.

If the land needs 61.5 kg P<sub>2</sub>O<sub>5</sub>/ha

PAHs

If the land needs 61.5 kg P<sub>2</sub>O<sub>5</sub>/ha we also add with **Plant type BC**:

+ 435 g/ha PAH

If the land needs 61.5 kg P<sub>2</sub>O<sub>5</sub>/ha we also add with Bone Biochar (ABC)

+ 0.1 g/ha PAH



**Recommendation:** Setting up a safe application rate (t/ha dosage) for plant base biochar for minimizing the risk from heavy metal loads.



## TARGET ORGANIC POLLUTANT: PAHs

- The occurrence of PAHs in biochar primarily derive from low grade and inefficient pyrolysis condition.
- **In industrial scale the pyrolysis technology performance is the prime definition factor for the biochar quality.**
- The sub-optimal pyrolysis operating industrial conditions may not only reduce the benefits associated to biochar application, but also enhance the risk of land and water contamination.
- If the nutrient content is low (plant biochar), there is a risk that large amounts of respective product could be used for a certain area to supply the plants with sufficient nutrient. **The higher application dosage results in higher PAH loads of the agricultural land.**



# BIOCHAR OUTPUT PRODUCT PERFORMANCE INDICATORS

1. **PERMIT AVAILABILITY:** the biochar product is Government Authority permitted for open ecological soil applications. Biochar production is under REACH above 1 t/y production from 2018.
2. **Meets all the WfD “end of waste criteria”**, where the biochar product is fully eco safe, economical market demanded and soil use optimized carbon – mineral product.
3. **Low VOC/PAH and other potentially toxic residuals.** PAH 6 mg/kg. Meet POP protocol.
4. **Stabile carbon**, mainly **macro porous** structured. Low temperature biochar = improved agronomic benefits. High temperature biochar = recalcitrant and better for carbon sequestration.
5. **BIOCHAR ECONOMY:** benefits VS costs are positive, incl. market based economical and environmental positive balance. Uses:
  - a) **Low dose:** NPK-C natural fertilizer bone char **200 – 1000 kg/ha.**
  - b) **Medium dose:** plant based biochar **2,500 – 10,000 kg/ha.**
  - c) **High dose:** plant based biochar **10,000 – 20,000 kg/ha.**



# REFERTIL CONCLUSIONS

1. **There is no one fit for all solution**, the climate, soil and local diversity must be considered.
2. The **recycling and reuse** of the Billion tons/year US/EU agri and food industrial waste streams is the critical element of the future sustainable food production supply.
3. The recycling and reuse processing is **supporting all types of agri cultivations, incl. low input, organic and GMO** as well.
4. The plant available and low/no heavy metal content **PHOPSHOROUS** is the biggest challenge for the **SAFE FOOD** production beyond 2015.
5. The recycling and reuse processing is creating strong and for long term sustainable **low carbon economy** and **stabile agri industrial jobs**.
6. The biochar production pyrolysis performance is the most important definition factor for the biochar quality in industrial scale. Advanced BC production processing is towards zero emission performance.





# THANK YOU!

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