

# PROTECTOR

Contract number  
FOOD-CT-2005-514082



## Recycling and upgrading of bone meal for environmentally friendly crop protection and nutrition

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November 9, 2009.

### **The strategic impact of the PROTECTOR project on AGRI industry and research sector**

**The innovative 3R “Recycle-Reuse-Reduce” PROTECTOR technology provides recycling of agricultural organic and mineral by-products provides carbon products for soil amendment and restoration of soil natural balance.** The input feed stream is refuse grain, food processing and/or other by-products. The innovative technology providing surface modified charcoals and minerals for plant availability. The process is upgrading by-products to high added-value plant growth promotion and natural fertilization products for environmentally friendly vegetable cultivation, with carbon sequestration potential. The 3R is a horizontally arranged and indirectly heated low temperature zero emission carbonization system (operating under vacuum, up to 850 °C $\pm$ 50°C material core temperature) and directly integrated novel agro biotechnological processing units of agroc carbon specific solid state fermentation and formulations.

**The PROTECTOR project provides a solid Trans-European knowledge-base innovative technologies for recycling and upgrading of bone meal for environmentally friendly crop protection and nutrition which contributes to the competitiveness and sustainability of major European Eco-industries and biobased economy. The PROTECTOR measurable, justified and verified scientific and technological achievements will open new technical and economical perspectives for the competitive European vegetable production industry, resulting in safer, higher quality and less costly vegetables for the Consumer.**

The project's essential role in the recycling and transformation of food chain organic waste into added-value products, by advanced biotechnological methods, provides **new dimensions of change “from quantity-to-quality”**. PROTECTOR will realise Consumer-demanded “farm-to-fork” vegetable and food products that are both safe and affordable. Considering the fact that vegetables are the second most important food supply after dairy products in the EU, the PROTECTOR activities will strengthen the scientific and technological knowledge base that is required to improve the health and well-being of European citizens; this will be achieved through a higher quality of food, improved control of food production practices and of related environmental factors.

A side effect of sustained heavy P fertilizer additions can be the accumulation and introduction into the human food chain of heavy metal contaminants contained in fertilizers. Phosphate fertilizer use has caused small but significant increases soil cadmium levels. These inputs are of a magnitude similar to those from the atmosphere in industrialised countries. There are still no agreed safe Cd limits for soils, but it appears that concern about Cd build-up in soils may be warranted only where several critical factors combine, i.e. on acid soils with low cation exchange and low P fertility, to which significant P fertilisation is applied as low grade fertilizer or rock phosphate, particularly to Cd accumulators like leafy vegetable crops, and where the produce is the main source of local food consumption. **Phosphorus containing**

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**fertilisers can contain high levels of cadmium depending upon the source of rock phosphate used in manufacturing.** Trace element fertilisers and phosphogypsum may also contain high cadmium levels. **Consequently, these chemosynthetic fertilisers can be a major source of cadmium in horticultural soils.**

Reasons for looking at alternative and renewable sources of phosphorus (P) for agriculture and horticulture include the near future depletion of economically recoverable low Cadmium/Uranium content phosphate rock (PR) reserves and the need to restrict introduction of toxic metals to agricultural soil via fertilizer, for which animal bone is a clean P source. For example, reviews show that cadmium concentrations range up to only 3.03 mg kg<sup>-1</sup> in cattle and pig bone (Doyle 1979) but up to 556 mg kg<sup>-1</sup> in PR (Van Kauwenbergh 1997). However, concerns have arisen about the transmission of diseases through animal byproducts and in the European Union, regulations control their disposal (EU 2002). Controlled thermal treatment exceeding about 400°C can be used to make a form of biochar that is free of infective agents, rich in P, and that we call animal bone char (ABC). ABC appears potentially an effective P fertilizer but, prior to the current project, had not been tested for this purpose.

The project impact on the agricultural sector, and crop protection in particular, is really important for several reasons.

- PROTECTOR is a new organic fertilizer, that can replace polluting and hazardous phosphate fertilizers, offering farmers the opportunity to fertilize their crops increasing at the same time food quality and security.
- PROTECTOR showed to control soil-borne plant pathogens and can be considered as a new tool for crop protection. The recent pesticide bans set by EU, in particular for crops like small fruits and vegetables, will promote the use of more environmental friendly practices in the crop protection field. PROTECTOR has a promising role in such regard, giving farmers a new tool for controlling soil-borne pathogens.
- PROTECTOR combines a several effects on plants: nutrient supplier and carrier for biological control agents. This combination of effects strengthen the efficacy of the product and represent a new and innovative product in the agricultural sector.

The output PROTECTOR end product provides combined effect, and used in the organic and low input farming agriculture with special aim to the vegetable and medical herb plant cultivation:

- Biological control effect against soil borne plant pathogens, for substitution or significantly lower the input of agro chemicals.
- Plant growth promotion, for natural substance support to get higher plant yields with better quality and safer products.
- Natural fertilization: Food crop mineral deficiency and disturbance stress mitigation in temperate climate regions by restoration of soil natural balance. Substitution of highly energy intensive artificial fertilizers.

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