CULTIVATING CAMELINA FOR SUSTAINABLE AVIATION FUELS IN EU MED MARGINAL LAND RECOVERED WITH CO-COMPOSTED BIOCHAR AND DIGESTATE: PRELIMINARY RESULTS

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The H2020 BIO4A project aims at producing and deploying Sustainable Aviation Fuels (SAF) at large scale in Europe. A major oil refinery, owned and operated by Total based on Axen's technology, will run in non-segregated full jet-mode, targeting the production of 5 kt of ASTM-certified bio-based HEFA jet fuel. The produced SAF will then be used in commercial passenger flights: the demonstration activities will be complemented by market and policy analysis. While this part of BIO4A represent the industrial component of the project, the issue of developing additional alternative routes for supplying sustainable lipids to the HVO process represents the key R&D part: this addresses the production of Camelina in EU MED marginal land, recovered by biochar or COMBI addition.

The production of a novel soil amendment, here named COMBI (COMpost + BIochar), and the evaluation of its performances to increase soil resilience in marginal lands prone to desertification in Spain, are therefore the main R&D actions. Co-composted biochar and digestate obtained from biomass anaerobic digestion has been produced and characterized. The use of Biochar and COMBI in marginal land mostly aims at increasing organic matter to the soil, favouring nutrient recycling and availability, increasing soil water holding capacity, and sequestering fixed carbon, thus contributing to the Paris Climate agreement (Climate Change mitigation) and the UN Sustainable Development Goals. In particular, the carbon removed from the atmosphere, differently from most of the CCS routes, where C is stored, is employed to support the adaptation of difficult agricultural lands and regions to climate change, improving soil and agriculture resilience (Climate Change adaptation).

Biochar was produced from chestnut woodchips, thermo-chemically converted through the 50 kg/h oxidative slow pyrolysis unit developed at RE-CORD lab, while digestate was obtained from a mesophilic anaerobic digestion plant mostly fed with animal manure.

Co-composting was carried out in two different periods: the first one, during the Summer season in Tuscany (IT) in a greenhouse using static windrows, equipped with temperature and moisture sensors, and turned manually twice per week; the second campaign was conducted in the same location, but during the winter season.

The characteristics of different types of co-composted biochar-digestate-straw blends (COMBI) were assessed. Main physical and chemical properties were analyzed with respect to the European Biochar Certificate (EBC) standard and the European Compost Network specifications, that developed the European Quality Assurance Scheme (ECN-QAS), for the solid fraction of digestate. The potential dynamic respiration index (PDRI) test was carried out to investigate the biological stability of the solid digestate. The Brunauer–Emmett–Teller (BET) analysis was also performed on the biochar component, so to characterize the biochar in terms of total porosity and pore diameters distribution using the density functional theory (DFT) method.

The test compared the composting process of the digestate only with the co-composting process of the same organic matter with the addition of increasing rates of biochar, up to 15% w/w d.b. Results were compared in terms of duration of the bio-oxidative phase and the maximum temperature reached. Products obtained were characterized and compared as regards yield (in terms of organic matter), Humic and Fulvic Acid content, Nitrate and Ammonium-N content.

The products were then applied to two sites in Spain, before seeding Camelina crop: each site comprised 7 different microplots of 10 m^2 each, and 4 repetitions. The microplots included soil without fertilization (control), soil with NPK fertilization, soil with three different blends of COMBI, soil with only biochar, soil with composted digestate alone. The test sites were located in two different areas of Spain, one South and the other North of Madrid. The same site will continue to be tested in normal rotation with barley over the following two years.

The present works report the results of the on-going test campaign, assessing and discussing the benefits of the soil restructuring.

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