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Expression of interest - SURPLUS

Green biorefinery development to realize the potential of doubling biomass yield for food, materials and energy and halving environmental impacts of non-water-limited north-west European agricultural systems (WINWINREFINERY)

Objectives

- To sustainably intensify agricultural systems by improved utilization of the whole growing season
- To develop green biorefinery processes, products and markets with a primary focus on the prospects for increasing EU protein self-sufficiency
- To gather key European knowledge and stakeholders in green biomass production & refining, and match up with animal feed industry markets as well as other biobased product markets in order to develop the framework for a new agro-industrial business sector

Innovation

In humid temperate conditions grasses, beets or double crops can utilize the growing season for solar radiation capture much more efficiently than can annual grain and seed crops that use a considerable part of the season for ripening, harvest, soil tillage and sowing. Potentially, biomass yields can be doubled as shown from both modeling and field experiments in e.g. Denmark. However, these biomasses do not directly fit into current agricultural markets which have been incrementally developed over centuries for utilization of mainly grain and seeds for feeding monogastric animals (including humans). However, industrial separation and upgrade of components of these resource efficient biomasses holds promise for coupling the best biological potentials with new industrial technologies into a radically improved agro-industrial system. Especially interesting is the high content of protein of a good amino acid composition in grass and legume crops. Provided that the protein can be efficiently extracted and formulated into feed (or food) products it will increase self-sufficiency of Europe with protein produced in a sustainable way.

Several environmental indicators will be significantly improved if annual cropping systems are substituted by perennial or double crops covering the soil year-round; nitrate leaching and pesticide use can be reduced by 50-90%, while soil carbon can be build up as opposed to the current break-down or steady-state in annual crop rotations. Other GHG emission may also be reduced but this is a more complex issue and needs further investigation and optimization. Even though water *quality* will be improved be changing cropping systems, water *quantity* (surplus for ground water and river discharge) will be reduced due to higher annual crop evaporation. Thus, potentials for such improvements are at first hand highest in humid north-western Europe, even though some optimizations may also be feasible in water-limited areas.

Project content

The partners have already significant experience in different links of the whole green biorefinery chain, and the project will ensure that these experiences are collected, analyzed, discussed and extended by new data in order to set up whole chain concepts that are productive, sustainable, economic and commercially feasible for existing markets. Different concepts of cropping, harvest & storage, separation, upgrading, product suites, and market development will be described and scrutinized economically, technically and in a sustainability perspective. These comparative scenarios (e.g. decentralized versus centralized; feed, energy or chemical focused lines; storage of biomass versus storage of intermediate products) will be used to showcase the industry, public and policy stakeholders on the suite of options for radically innovated agro-industrial systems, and will aim at improving the conditions for investments in a new bioeconomy sector. Pedoclimatic and socioeconomic conditions will vary across partner countries and will give rise to different regional scenarios and business opportunities.

Impact

- New concepts for radically innovated and more resource efficient agro-industrial production chains will be designed, developed and analyzed
- Most promising business cases will be discussed with potential stakeholders with the ambition of promoting a new agro-industrial sector for improved European self-sufficiency in protein, and for delivery of other valuable ecosystem, material and energy services
- Environmental challenges such as the Water Framework Directive implementation, agricultural climate resilience and GHG mitigation, and ambitions of reduced pesticide use can be solved by increased productivity, and not, as most often proposed, by reduced intensity of production.

Structure (very preliminary)

The project will consist of X WP's that will address each link of the production chain separately and in overarching analyses:

WP1: designing resource efficient agricultural systems

Task 1-3……

WP2: optimizing biomass harvest, pretreatment, storage and transport …..

WP3: decentralized simple biorefining for e.g. animal fodder, fibres, biogas and fertilizer

WP4: biorefining of high-value components from green biomass

WP5: environmental analysis

WP5: economic analysis, business development and policy support

WP6: social implications of radical innovations in agro-industrial systems (rural development, public acceptance etc.)

WP7: project coordination and dissemination