

BEST-CROP: BOOSTING PHOTOSYNTHESIS TO DELIVER NOVEL CROPS FOR THE CIRCULAR BIOECONOMY

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There is a need for a ground-breaking technology to boost crop yield (both grains and biomass) and its processing into materials of economic interests. Novel crops with enhanced photosynthesis and assimilation of green-house gasses, such as carbon dioxide (CO₂) and ozone (O₃), and tailored straw suitable for industrial manufacturing will be the foundation of this radical change. We are an alliance of European plant breeding companies, straw processing companies and academic plant scientists aiming to use the major advances in photosynthetic knowledge to improve barley yield and to exploit the variability of barley straw quality and composition. We will capitalize on very promising strategies to improve the photosynthetic properties and ozone assimilation of barley: i) tuning leaf chlorophyll content and modifying canopy architecture; ii) increasing the kinetics of photosynthetic responses to changes in irradiance; iii), introducing photorespiration bypasses; iv) modulating stomatal opening, thus increasing the rate of CO₂ fixation and O₃ assimilation. Beside the higher yield, the resulting barley straw will be tailored to: i) increase straw protein content to make it suitable as an alternative feed production source; ii) control cellulose/lignin contents and lignin properties to

develop construction panels and straw reinforced polymer composites. To do so, we aim to exploit barley natural- and induced-genetic variability as well as gene editing and transgenic engineering. Based on precedent, we expect that improving our targeted traits will result in increases in above ground total biomass production by 15-20% without modification of the harvest index, and there will be added benefits in sustainability via better resource-use efficiency of water and nitrogen. A public dialogue will be established to ensure stakeholder engagement and explore the acceptability of a range of technologies as potential routes to crop improvement and climate change mitigation.