Agrobiotechnological Direct Air Capture Towards Carbon Circulation Society

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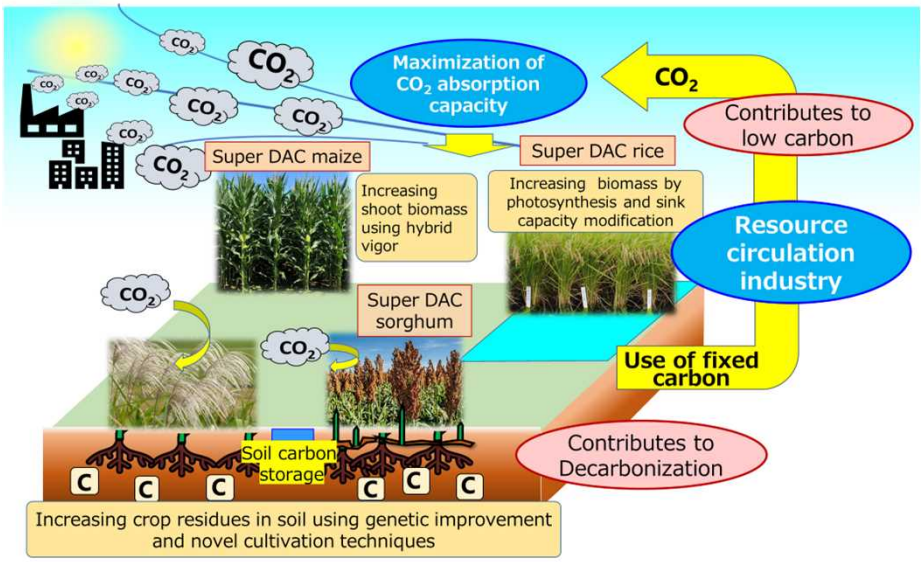
Summary

The reduction of greenhouse gases is an urgent issue, and as an innovative decarbonization technology, Direct Air Capture (DAC), which captures carbon dioxide (CO_2) diffused into the atmosphere, is attracting a great deal of attention. In this context, agriculture itself can be regarded as a DAC technology, since crops absorb CO_2 through photosynthesis and fix it as biomass. However, the problem is that the carbon that is currently fixed in the form of agricultural products and crop residues is consumed in a short period of time as food, etc., or is plowed into the field and decomposed, returning to the atmosphere as CO_2, making it difficult to link its DAC capacity to decarbonization. This project will achieve the development of crops with dramatically improved CO_2 fixation capacity and increased biomass production capacity, thereby contributing to the realization of a new type of agriculture (DAC agriculture) in which the resulting biomass can be used to produce energy and useful substances that contribute to decarbonization. To realize DAC agriculture, we will develop lines that dramatically increase the biomass of three crops widely grown in Japan and overseas countries: rice, maize, and sorghum. Genome editing technology will be used to modify genes that increase the photosynthetic capacity of paddy rice and sink capacity, and hybrid vigor through crossbreeding with related wild species will be used to increase the biomass of maize. We will also increase the roots and stems of sorghum that remain in the ground to maximize the carbon sequestration capacity of arable land. In addition, the project will evaluate the environmental and economic impacts of crop biomass production and utilization.

This project aims to realize a new carbon-circulating society that can make a significant contribution to global warming mitigation by utilizing the agricultural base used for food production, securing biomass feedstock, and achieving a balance between decarbonization and food production.



KPI

FY2024

1. Developing rice lines increasing sink capacity by 15% and source capacities by 10%.
2. Developing maize F_1 lines producing twice the shoot biomass of current varieties.
3. Selection of breeding materials for developing sorghum lines that double the underground biomass.
4. Determine the carbon dynamics in soil derived from crop residues.
5. Evaluation of environmental impact and economics in crop production and resource recovery.

Implementation

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