Development of Environmentally Robust Crops based on Crop Design technology

"Food insecurity threatens peace" is a relatively common expression. Accomplishment of our Moonshot would enable us to create crops that are highly adaptable to the environment and to swiftly spread them worldwide, thereby globally addressing risks of food shortage and helping in the establishment of a peaceful future for the next generation.

We also believe that "full utilization of crop functions" will contribute to not only ensuring crop robustness but also achieving a wide range of Sustainable Development Goals (SDGs), as it will be possible to overcome environmental problems and respond to innovations in industrial technology.

Project Manager (PM): Dr. FUJIWARA Toru
Professor, Graduate School of Agriculture and Life Sciences, The University of Tokyo

Achieving zero food risk by improving crop robustness through cyber-physical systems

Keywords: Environmental degradation, Crop design, Wild plants

Background

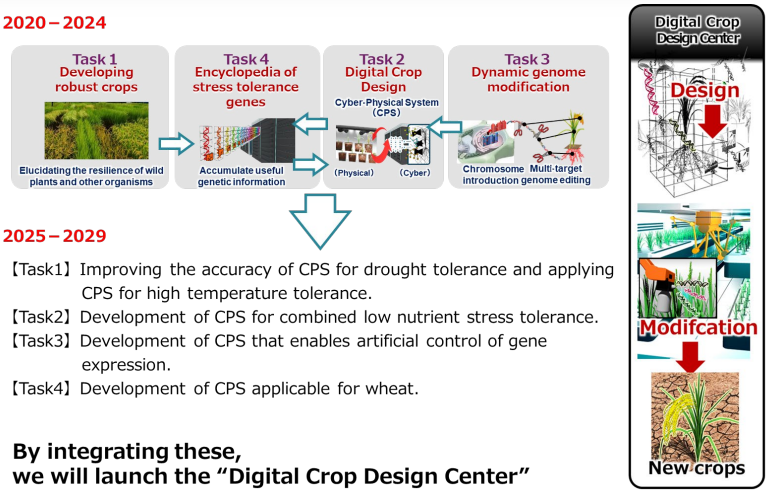
Need for robust crops capable of coping with environmental degradation caused by global warming

In 2050, the world population is expected to reach 9.7 billion, requiring 1.7 times more food than as of 2010. However, the progression of global warming has increased the prevalence of extreme weather conditions worldwide. In addition, the slowing production growth of major grains will make it difficult to meet our grain needs in 2050. Development of crops that are strong and tolerant enough to cope with environmental degradation caused by global warming is an urgent necessity.

Research Contents

Elucidating the "robustness" of wild plants and establishing a digital crop design technology

In order to solve the above problems, we have obtained information of the stress tolerance mechanisms in wild plants (Task1) and integrated this information as genetic database (Task4). In addition, we have achieved a highly efficient technology for accurately editing multiple gene regions simultaneously (Task3). We have succeeded in 20% increase in seed weight under drought stress condition by using predictions of drought related genes in cyberspace (Task2). With these efforts, the prototype of the crop design technology was completed by 2024. From 2025, we have set new four tasks with the aim of sophisticating and diversifying the crop design technology we have built over the first five years.



Targets by 2030

By 2030, we will improve the system to design crops in cyber space by fully utilizing the outstanding biological functions of wild plants or wild plants genomes.These systems will enable us to rapidly develop crops with high environmental adaptabilities that will result in increased food production. In addition, we will start operating the "Digital Crop Design Center" as a base for implementing the results of our research in society and releasing robust crops with the aim to eliminate verification of the designed crops in physical space and enabling the development of new crops in cyberspace alone.

Cooperating Research Institutes

The University of Tokyo / National Agriculture and Food Research Organization / RIKEN / Tokyo University of Agriculture and Technology / Kyoto University / Tottori University / Yamaguchi University / Kyushu University / The University of Shiga Prefecture / Fukui Agricultural Experiment Station