



CONCERT-Japan Food Crops and Biomass Production Technologies

INTERIM REPORT

“Towards a multi-approach study focused on Improving Resource Use Efficiency in Cereals under Climate Change”

IRUEC

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The climate is changing and this has global ramifications for agriculture, with many countries projected to face extremely high stress in the coming years. In the last few decades, yields of the world's major crops have stagnated. The goal of the IRUEC project is to identify agronomic, physiological, and molecular bottlenecks (at the genomic, proteomic and metabolomic levels) controlling yield, quality, and resource use efficiency of target crops for food security such as rice, wheat, and tritordeum under a variety of environmental conditions (drought, elevated CO₂, and high temperature) and their interaction with fertilization practices. The five IRUEC consortium partners combine multidisciplinary competences in agronomic, phenomic, proteomic, and modelling approaches in the area of food crops and biomass production in response to certain environments.

During the first year, two experiments were conducted in Valladolid, Spain (wheat and tritordeum) and Niigata, Japan (rice) in order to identify cultivars with the higher nutrient use efficiency (NUE) when exposed to drought conditions. Regarding the experiment conducted in Spain, crops were grown under full irrigation (Zamadueñas trials) and drought (Villadiego trials) conditions. However, the fact that during 2018 the average precipitation in Zamadueñas and Villadiego was above average, the consequence was a lack of drought effect. Because one of the objectives of this study was to identify a target gene linked to better performance under changing environments, for the later stages of development in wheat plants overexpressing such a gene, IRUEC members agreed to conduct the gene identification based on results described in previous publications and experience acquired in recent years. Regarding the rice experiment carried out in Niigata, there were no setbacks with the experiment and the rice cultivars were grown under the scheduled conditions. Based on the grain quality analyses carried out in wheat, tritordeum and rice cultivars during 2018, 10, 5, and 10 cultivars, respectively, were identified as having the highest resource use efficiency for the elevated CO₂ and/or high temperature experiment projected for 2019.

In terms of project management, as scheduled, the kick-off meeting was conducted at the Agrobiotechnology Institute (IdAB-CSIC) in December 2017 to coordinate the work for the first year and initiate the management program. The second meeting was carried out in Niigata (September 2018) with the goal of summarizing/discussing the results/problems of the first year and to facilitate subsequent adjustments to the second year program. The next meeting will take place in Munich (June 2019).

The IRUEC project's successes and outcomes have been communicated at national and international scientific meetings to experts in the field, within the press and other media, and at general public events. It should also be noted that the experiment undertaken in the first year has been part of a Master's project at the University of Barcelona and this work is being prepared as a manuscript. Partner 1 and 2 are editing a special issue for *Frontiers in Plant Science* in a topic tightly linked to IRUEC research goals. Within the context of research exchanges between the different partner laboratories, a visit by researcher to Niigata University is scheduled for April 2019 with the goal of learning (phospho)-proteomic protocols. Similarly, a visit by a PhD student from IdAB-CSIC (Partner 1 laboratory) to UPS2 (Partner 4) has been set for next September-November to get training on metabolomics. In addition, under the coordination of Dr. Aranjuelo (partner 1), Professor Mitsui / Dr. Baslam (partner 2) and Professor Araus (partner 3) are working on an H2020 project proposal for the 2019 round of applications.