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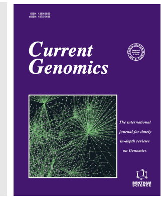
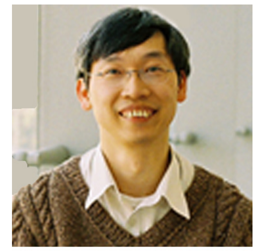


Editorial

Enhancement of Plant Productivity in the Post-Genomics Era

N.P. Thao



L.-S.P. Tran

Obtaining high plant yield is not always achievable in agricultural activity as it is determined by various factors, including cultivar quality, nutrient and water supplies, degree of infection by pathogens, natural calamities and soil conditions, which affect plant growth and development. More noticeably, sustainable plant productivity to provide sufficient food for the increasing human population has become a thorny issue to scientists in the era of unpredictable global climatic changes, appearance of more tremendous or multiple stresses, and land restriction for cultivation.

Well-established agricultural management by agrotechnological means has shown no longer to be effective enough to confront with this challenge. Instead, in order to maximize the production, it is advisable to implement such practices in combination with biological applications. Nowadays, high technologies are widely adopted into agricultural production, biological diversity conservation and crop improvement. Wang *et al.* has nicely outlined the utilization of DNA-based technologies in this field. Among these are the applications of (i) DNA markers into cultivar identification, seed purity analysis, germplasm resource evaluation, heterosis prediction, genetic mapping, cloning and breeding; and (ii) gene expression data in supporting the description of crop phenology, the analytic comparison of crop growth under stress versus non-stress conditions, or the study of fertilizer effects. Besides, various purposes of using transgenic technologies in agriculture, such as generating cultivars with better product quality, better tolerance to biotic or abiotic stress, are also discussed in the review.

One of the important highlights in this issue is the review of the benefits brought by high-throughput sequencing technology, which is also known as next-generation sequencing (NGS). It is not so difficult to recognize that its application has allowed us to carry out biological studies at much deeper level and larger scale. In their article, Onda and Mochida detailed how to use these technologies in fully characterizing the genetic diversity or multigenecity within a particular plant species. The authors discussed the constant innovation of sequencing platforms which has made sequencing technologies become more superior and more powerful than ever before. Additionally, the efforts result in not only further cut down of the sequencing cost and increase in the sequencing speed, but also improvement in sequencing accuracy and extended sequencing application to studies at both DNA and RNA levels. Such knowledge will help the scientists interpret, at least partially, how plants can adapt to various environmental conditions, or how different cultivars can respond differently to the same stress. Another article by Ong *et al.* also laid emphasis on the importance of various high-throughput sequencing platforms, thanks to which a large number of genomic databases supplied with detailed annotation and useful bioinformatics tools have been established to assist geneticists. Readers can find in this review the summary of available plant-specific genomic databases up-to-date and popular web-based resources that are relevant for comparative genomics, plant evolution and phylogenomics studies. These, along with other approaches, such as quantitative trait locus and genome-wide association study, will lay foundation for prediction and identification of genes or alleles responsible for valuable agronomic traits, contributing to the enhancement of plant productivity by genetic engineering approach.

In this thematic issue, specific examples for crop improvement are also demonstrated. The first showcase is given by Nongpiur *et al.* who provided evidence that synergistic employment of genomics approaches and high-throughput gene expression methods have aided in dissecting the salinity-responsive signaling pathway, identifying genes involved in the stress response and selecting candidate genes for further characterization aimed at generating new cultivars with better salinity stress tolerance. This paper is also a good reference source for readers who wish to get an overview about the general process from gene prediction to validation by experiments, including the details on techniques and approaches used. Another demonstration is provided by Khan *et al.* whose interest is enhancement of drought tolerance in crops. The focus of this article is to overview our current understanding of mechanisms regulating plants responses to drought. Evaluation of plant performance to drought and production of new elite varieties with better drought tolerance on the basis of using phenotyping and genomics-assisted breeding are also well discussed.

In addition to the topics of environmental stress tolerance in plants, current knowledge on improving biotic stress tolerance is also summarized in our issue. Current picture on crosstalk of signaling mechanisms in rice between its immune system and symbiosis with microorganisms is presented by Akamatsu *et al.* Rice responses to bacteria and fungi via interactions between the plant pattern recognition receptors and the molecular microbe-associated molecular patterns are described in detail and suggested as targets for manipulation in order to increase disease resistance in crops. On the other hand, Bouain *et al.* are concerned about nutrient deficiency; specifically, how plant root system develops under growing conditions with inadequate phosphate. The authors overviewed our current understanding of the low phosphate-responsive mechanisms in *Arabidopsis* model plant, which was gained by using a combination of various advanced methods, including high-througput phenotyping, system biology analysis and "omics" technologies. Stress management in plants is proposed to be also achievable by regulating activities of cyclic nucleotide-gated ion channels. As emphasized in the paper of Jha *et al.*, the application of such channels is important in mediating cellular ion homeostasis and plant tolerance to both biotic and abiotic stresses.

In summary, with recent progresses in biological and biotechnological areas, especially rapid development of advanced technologies in biological system modeling, functional genomics, computer-based analyzing tools, genetic engineering and molecular breeding, biological control and biotechnological applications in agriculture have brought about an extraordinary revolution and have been considered the most powerful approaches in maintaining or even increasing crop yield. Therefore, in this issue, we would like to introduce to the audience a collection of various strategies used for enhancing crop productivity, with the focus on advanced biological-biotechnological platforms in the post-genomics era.

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