Editorial

Plant Quality Improvement and Nutrigenomics

L.-S. P. Tran

The three cardinals of human diets i.e., starch, protein and oil, are derived primarily from vegetable sources. With world's increasing population, there is urgent need not only to increase the output of existing crops but simultaneously improve their qualitative aspects as well. Additionally, emphasis is also required to introduce new crops in supplying diets in order to ease burden of the existing crop plants.

Greater proportions of human population in the world derive their nutritional requirement of starch, primarily from rice. Large amount of publicly available information pertaining to both genomics and genetics in rice has enabled researchers to explore judiciously the molecular mechanisms control-

R. Kumar

ling traits of economic interests. The article by Mustafiz *et al.* has nicely put together the efforts of various omics tools towards genetic improvement in rice. The article laid emphasis of molecular-genetic studies involving both forward and reverse genetic approaches to provide unequivocal evidence with regard to functions of genes associated with traits of economic importance. Additionally, to assist rice researchers the review documents in detail the invaluable resources emanating from transcriptomic, metabolomic and proteomic studies. Moreover, authors have strongly supported the idea of concerted and cumulative efforts involving both scientific tools and stakeholders in solving various issues pertaining to genetic enhancement in rice which can accommodate both quantitative as well as qualitative improvement.

The second most important consideration to cater the increasing demands of human diets is the introduction of potential crops into our mainstream diets that can both supplement as well as reduce burden on primary starch yielding cereals crops such as rice and wheat. The above issue is addressed in article by Singh *et al.*, detailing information and resources available with coarse cereals. The authors have emphasized that combination of both classical 'molecular breeding' and modern 'omics' approaches has great potential in addressing the issues related to bottlenecks associated with coarse cereals, more particularly their effective utilization as dietary components for humans. Authors have made significant effort in successes achieved in coarse cereal nutritional aspects from studies involving molecular mapping and 'omics' tools (genomics, proteomics and metabolomics). The hallmark of the article is underlined by their suggestion of analyzing promising germplasm of coarse cereals through cores/mini-cores in order to effectively solve the deficiency in traits of nutritional importance. Another article by Sytar *et al.* also laid the emphasis on importance of inclusion of non-traditional buckwheat (*Fagopyrum esculentum* Moench) plants to address the problem of food for masses. The absence of gluten in flour of some buckwheat germplasm determines its potential use in gluten-free diets. Moreover, the seeds of buckwheat used for food contain proteins which have high lysine levels and specific amino acid content, giving them a high nutritional value. The review describes the importance of biochemical evaluation of buckwheat genetic resources and the identification of elite genotypes for plant breeding and exploitation.

Crop plants often subjected to various types of stress, leading to severe curtailment in overall productivity. Besides increasing the crop-base, the article by Xu *et al.*, discusses the importance of studying halophytes in gaining our deeper understanding of salinity tolerance mechanism. Among various abiotic stresses, salinity is one of the major factors detrimental to overall crop productivity. Halophytes, because of their evolutionary advantage, possess salt tolerance mechanisms in order to ensure their normal growth and development under saline conditions. This review discusses the various physiological and molecular mechanisms employed by halophytes for maintaining their optimal growth in saline conditions, and also focuses on the advances in research of regulatory mechanisms in halophytes. In another article, Xu *et al.*, discuss the mechanistic relationship of calcium ion with regard to mitochondria which plays an important role in energy production, regulatory signals transfer, programmed cell death of apoptosis and thus has important roles in overall plant productivity. The review outlines the recent discoveries of the mitochondrial calcium ion channel complex involved in calcium assimilation.

Proteins are essential components of our diets. Dietary proteins for a proportion of population are primarily derived from vegetable sources. The review article by Le *et al.*, discusses the incompleteness of plant proteins in supplying nutritional amino acids as essential amino acids, namely methionine, lysine, and tryptophan that are present in limited quantity in a variety of plants, particularly in cereals and legumes, which are the major crops for human consumptions. The review discusses the biotechnological approaches for increasing essential amino acid content in legumes and cereals. Taken together, the review emphasizes the importance and feasibility of research potential for metabolic engineering to create nutritionally enriched plants.

Among our diets, oils derived from vegetable sources are indispensable components for providing energy-rich fatty acid metabolites. It is the composition of fatty acid constituents in seed oil that determines its end-use. Great successes have been achieved in metabolic redesigning of vegetable oil constituents through genetic engineering approaches. The review by Kumar *et al.*, discusses how to balance oil resources derived from plants for both human consumption and industrial application. The article enumerates advances in achieving the nutritionally desirable fatty acid-enriched plants. It also discusses genetic engineering approaches to modulate oil composition of crop plants to enrich desirable fatty acids. The review outlines the successes and bottlenecks in efficient production of novel fatty acids in non-native plants. In another article by Nguyen *et al.*, the authors discuss the effects of abiotic stresses on both qualitative and quantitative changes in oil and protein contents in soybean seeds

during its development. The article makes a convincing point in exploring roles of phytohormones in regulating oil accumulation during seed development. The review explains the important role played by hormones in overall metabolism and postulates that phytohormone in soybean seed plays an important role in fatty acid metabolism.

The successes achieved in the area of genetic enhancement of nutritional constituent of crop plants and any future strategies to accelerate our effort in that area should be constantly evaluated with regard to effects of such constituents on our diets. The later area, also known as “nutrigenomics”, deals with interaction of diets and human health. The review by Sytar *et al.*, outlines the positive health effects of bioactive compounds (resistant starch, dietary fibre, rutin and other polyphenols) present in buckwheat seeds. Another review article by Rana *et al.*, comprehensively discusses overall role played by emerging area of “nutrigenomics” tool to understand and devise strategy in achieving the desirable compounds in our diets. It discusses the interaction of selected nutrients with associated genes in specific organ or tissue necessary to comprehend knowledge as to how individual's genetic makeup responds to a particular nutrient. Such type of study allows researchers to understand the potential of food fortification or supplementation of diet. More importantly the area of “nutrigenomics” provides new opportunities to incorporate natural bioactive compounds into food for specific group of people with similar genotype. The importance of this review article is summarized by the fact that it incorporates various aspects of R&D in “nutrigenomics” to ascertain its impact on human health, especially with life-style associated diseases.

Taken together, the review articles published in this thematic issue collectively underscore the urgent attention required towards improving the qualitative constituents of crop plants through combination of both molecular and traditional approaches. Additionally, to meet the dietary demand of burgeoning population there is great scope in expanding our crop-base through judicious exploitation of germplasm available with potential crop species.

Lam-Son Phan Tran*Guest Editor*

Signaling Pathway Research Unit
RIKEN Center for Sustainable Resource Science
1-7-22 Suehiro-cho, Tsurumi-ku, Yokohama, 230-0045
Japan

Rajesh Kumar*Guest Editor*

Division of Genomic Resources
ICAR- National Bureau of Plant Genetic Resources
New Delhi
India