Because most regions of Japan are in the temperate climate zone, many deciduous and evergreen fruit crops are cultivated in Japan. In addition to fruit cultivation in the temperate zone, some southern areas, such as the Ryukyu Islands that stretch from Kyushu to Taiwan, are at the northern limits for tropical fruit production without the need of artificial heating. At present, annual fruit production in Japan (in billion yen) is as follows: citrus (Citrus spp.), 155; apple (Malus × domestica), 138; grape (Vitis spp.), 107; Japanese pear (Pyrus pyrifolia), 77; peach (Prunus persica), 48; persimmon (Diospyros kaki), 42; sweet cherry (Prunus avium), 39; Japanese apricot (Prunus mume), 21; kiwifruit (Actinidia delicosa), 9.6; Japanese chestnut (Castanea crenata), 8.9; European pear (Pyrus communis), 7.9; mango (Mangifera indica), 7.6; Japanese plum (Prunus salicina), 7.1; and fig (Ficus carica), 6.8 (MAFF 2016). Pineapple (Ananas comosus) and loquat (Eriobotrya japonica) are also economically important fruit species. Pineapple, mango, and papaya (Carica papaya) are major tropical fruits cultivated in the southern area of Japan.

Hundreds of new elite fruit tree cultivars have been bred and propagated over more than 100 years after modern cross-breeding practices were adopted in Japan. The ‘Fuji’ apple, ‘Kyoho’ and ‘Shine Muscat’ grape, and ‘Kosui’ and ‘Hosui’ Japanese pear cultivars are among the most representative cultivars bred in Japan. Because the fruit characteristics of cultivars principally bred in Japan are rather different from those bred outside of East Asian countries, many breeders and scientists throughout the world are interested in the breeding history of Japanese cultivars. Of note, special interest is paid to the breeding history of extremely high fruit quality cultivars, one of the most important characteristics.

In citrus, the primary objectives in breeding programs have been improving the satsuma mandarin to further increase fruit quality, fragrance, and stable production. ‘Kiyomi’ was bred in 1979, originating from a hybrid between the most popular satsuma mandarin cultivar ‘Miyagawa wase’ and the sweet orange ‘Trovita’. ‘Kiyomi’ and its progeny cultivars ‘Shiranuhi’, ‘Harumi’, ‘Setoka’, and ‘Harehime’ have been replacing the cultivation of mid-late ripening citrus varieties. The number of Japanese apple cultivars is estimated to be approximately 300, including 185 original cultivars registered since 1981. ‘Fuji’, ‘Tsugaru’, ‘Orin’, ‘Shinano Sweet’, and ‘Shinano Gold’ are major cultivars with excellent eating quality. The table grape breeding programs have combined the berry quality of V. vinifera with the ease of cultivation of V. labruscana by an interspecific crossing approach, resulting in the new excellent cultivars ‘Neo Muscat’, ‘Kyoho’, ‘Muscat Bailey A’, and the very recently developed ‘Shine Muscat’. The current Japanese pear breeding objectives mainly focus on combining superior fruit quality with multiple disease resistance (resistance to pear scab and black spot diseases) and self-compatibility, in order to breed new cultivars superior to the present major cultivars ‘Kosui’ and ‘Hosui’. In oriental persimmon breeding, pollination-constant non-astringent (PCNA) cultivars are the most desirable, because the fruit can be eaten without any postharvest treatment. Successful breeding of PCNA cultivars include ‘Yubeni’, ‘Soshu’, ‘Kanshu’, ‘Kishu’, and ‘Taishuu’. Because the PCNA genotype is recessive to the other three non-PCNA genotypes, molecular markers linked to the PCNA type have been developed and used for marker-assisted selection.

Breeding of perennial fruit trees is hampered by several disadvantages compared with annual crops, such as lengthy breeding cycles, from seed to fruit bearing, due to a long juvenile period, high cost of raising individuals to maturity in the field due to large plant size, and high heterozygosity occasionally preventing theoretical breeding approaches. The development of biotechnology and advent of genomics, such as the use of molecular markers and marker-assisted selection, rapid sequencing technology, whole genome sequencing for major fruit tree species, omics studies (transcriptomics, proteomics, metabolomics, hormonomics, ionomics and phenomics), genome-wide association studies, and genomic selection, have opened new opportunities to overcome these disadvantages in fruit breeding. In Rosaceae fruit species, two important international research programs, the USA-based international research program RosBREED (www.rosbreed.org/) and the European research program FruitBreedomics (www.fruitbreedomics.com/), have provided molecular and bioinformatics tools, superior pre-breeding materials, and valuable resources. It is expected that the international consortia as well as the Japanese research community of fruit trees will contribute to the breeding of healthy cultivars of high quality for consumers, by focusing on bridging the gap between breeding and genomics, and combining disease resistance with horticultural quality.

Japanese fruit tree research communities sometimes hesitate to present their research activities in English, especially regarding elite cultivars, genetic resources, and breeding systems for high fruit quality. Therefore, this special issue will introduce the comprehensive breeding, genetic, and genomic research in Japan on citrus, apple, table grape, persimmon, Japanese pear, and tropical fruits, and compare them with...
world-wide breeding programs. This issue also includes specific topics focusing on the genomics of Rosaceae fruit trees, native fruit tree genetic resources in Japan, genetic diversity of the wild Ussurian pear, omics studies in citrus, grape, and Rosaceae fruit trees, molecular mechanism of the S-RNase-based gametophytic self-incompatibility in Rosaceae, genomics-assisted breeding in fruit trees, and diversity of carotenoid profiles and expression of carotenoid-related genes in citrus. Finally, I would like to thank the Editor-in-Chief, Dr. Masaru Iwanaga, the Managing Editors, Prof. Mitsuo Omura, Dr. Hiroyuki Iketani, Dr. Kenji Katayama, and Dr. Masao Ishimoto, and all authors for contributing to and organizing this special issue.

**Literature Cited**

MAFF (Ministry of Agriculture, Forestry and Fisheries of Japan) (2016) http://www.maff.go.jp/j/tokei/kouhyou/nougyou_sansyutu/index.htm (Accessed 2016 February 1)

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