Grafting Methods for Producing Grafted Vegetable Seedlings in Korea

WS04-6: Applications of DNA Marker Technology in Japanese Bunching Onion Breeding

Hikaru Tsukazaki[1], T. Nunome[1], H. Fukuoka[1], H. Kanamori Kanamori[2], I. Kono[2], T. Ohara[1], Y. S. Song[3], K. Yamashita[1], T. Wako[1], and A. Kojima[1]

[1] National institute of vegetable and tea science, National Agriculture and Bio-oriented Research Organization, Tsu, Mie, 514-2392, Japan

[2] Institute of the Society for Techno-innovation of Agriculture, Forestry and Fisheries, Japan

[3] Mokpo Experiment Station, National Institute of Crop Science, Muan, 534-833, Korea

Japanese bunching onion (*Allium fistulosum* L.) is one of the most important vegetables in East Asian countries, particularly in Japan, China and Korea. The main breeding objectives in Japanese bunching onion are disease resistance, quality (low pungency, high sugar content) and suitability for mechanized farming (seedling growth) etc. However, genetic research in Japanese bunching onion is little known despite of its economical importance. QTL analysis based on genetic linkage map is valuable for understanding the mode of inheritance about these agronomic traits. To establish a genetic basis for the breeding of Japanese bunching onion, we isolated more than one thousand of simple sequence repeat (SSR) clones from size-fractionated genomic DNA libraries and SSR-enriched ones, and constructed a genetic linkage map by using these SSR and onion (*A. cepa* L.) markers. At present, we are investigating DNA markers linked to agronomic traits such as seedling growth and low pungency. Japanese bunching onion is allogamous and therefore contains a high degree of genetic heterogeneity within each cultivar. We propose a "SSR-tagged breeding" scheme which consists of selecting individuals that are homozygous at a few SSR loci in foundation seed field and obtaining seeds. This scheme should enable cultivar identification and F1 purity test in any allogamous crop in which inbreeding depression is as severe as in Japanese bunching onion.

18:00-21:00

Workshop 05: Current Advances in Herbaceous Grafting

Location: 317, COEX Conference Center

Chairperson: Sang Gyu Lee

Research Coordination Division, Rural Development Administration, 444-707, Suwon, Korea

Introduction

Herbaceous grafting has been used to index viruses, combine desirable traits in grafted plants, overcome soil-inhabiting pathogen pressure, construct chimeric plants, and to obtain aesthetically pleasing ornamentals. Now, the use of seedling grafts has become a standard practice in growing such fruit-bearing vegetables as watermelon, cucumber, muskmelon and tomato in Korea, Japan, and some other countries. Plants grown from seedling grafts are usually superior than non-grafted plants in yield and quality performances. The objective of this workshop is to update the current status of herbaceous grafting as practiced in horticultural crop production around the world. The use of grafting machines and proper handling of grafted plants will also be demonstrated during this workshop.

WS05-1: Grafting Methods for Producing Grafted Vegetable Seedlings in Korea

Sang Gyu Lee

Research Management Division, Rural Development Administration, Suwon, 441-707, Korea

The use of grafted seedlings has been increasingly popular in South Korea for many fruit vegetables including watermelon, cucumber, oriental melon, muskmelon, tomato, eggplant, and red pepper. The main purpose of grafted seedlings is to increase the yield and quality of fruits by combining a disease resistant rootstock with a genetically superior scion. A number of grafting methods have been employed including, including insertion graft, inarching, use of inter-stock, approach graft, cleft graft, pin-graft, and side graft. In South Korea, the inarching method of grafting has been popular because its success rate does not fall too low when a controlled environment grafting facility is not available. However, grafting by inarching requires more labor and additional materials as compared to other methods of grafting. A solution for this problem may be the use of an alternative method of grafting, such as

insertion grafting or a combination of root pruning and insertion grafting, which can be performed with a grafting machine. In any case, good connection of vascular bundles between the rootstock and the scion is essential for successful grafting and healthy growth and development of the grafted plants. Growing grafted plants in optimum environmental conditions is also important.

WS05-2: Practices of Vegetable Seedling Grafting in Japan

Masayuki Oda
Graduate School of Life and Environmental Sciences, Osaka Prefecture University, Sakai, Osaka, 599-8531, Japan

In vegetable production in greenhouses, most of the damages by continuous cropping are caused by soil-borne diseases and nematodes. As a countermeasure to the damage, such as Fusarium wilt, bacterial wilt and nematodes, grafting of fruit-bearing vegetables is popular in Japan. The proportion of the area using grafted plants of watermelon, cucumber, melon, tomato and eggplant was 57%, 59% and 59% of the total production area in 1980, 1990 and 1998, respectively. Plants have been grafted onto various rootstock species and cultivars by various grafting methods. Recently, tube grafting method has been developed for plug seedlings and becomes popular. Healing and hardening is fatal factors for the survival of grafted plants. Before the grafting, exposing seedlings to the sunshine and withholding water supply for two to three days induce successful grafting. For the healing of grafted plants, high humidity should be kept not to dry the cut surfaces of grafted plants. In the hardening after healing, by frequent checking of the state of grafted plants is very important for the survival, especially under conditions of temperature fluctuation. Since grafting gives increased disease tolerance and vigor to crops, it will be more popular for the low-input sustainable horticulture.

WS05-3: Current Technology and Status of Seedling Grafting in North America

Chieri Kubota
Department of Plant Sciences, The University of Arizona, Tucson, Arizona, 85721-0036, USA

Grafting is a well-known propagation technique for orchard and vineyard crops in North America. The application to vegetable seedlings, however, is relatively unknown, mainly due to limited availability of grafted seedlings and lack of information and technologies specially needed to adopt the technology in North American vegetable crop production. Majority of commercial grafted seedlings are currently used by greenhouse growers who seek increased yield and better quality of the produce. Grafting onto specific rootstocks generally provides resistance to soil-borne diseases and nematodes. Use of grafting is known to be an effective technology of sustainable crop production with reduced soil fumigants in many other countries. This particularly attracts organic vegetable producers. However, more information and research data are needed to adopt this technology widely in North American fresh vegetable production. Currently, over 30 million grafted tomato seedlings are estimated to be used annually in North American greenhouses, and several commercial trials have been conducted for promoting use of grafted seedlings in open-fields. However, there are issues identified that currently limit the further promotion of the use of grafted seedlings in North America. One such issue is the necessity of techniques of producing/handling large amounts of grafted seedlings with limited labor input, such as techniques of automation, storage, and distance transportation. Strategies to resolve these issues include use of highly controlled environment for producing standardized seedlings suitable for automation, introduction of sorting and grafting robots, better storage and long-distance transportation techniques, which will be discussed in the present workshop.

WS05-4: Production and Export of Grafted Cactus in Korea

Chang Hui Cho, Seung Min Hong, and In Tae Park
Cactus Research Institute, Goyang, 411-809, Korea

Grafted cactus is one of the major exported floricultural plants in Korea. Korea now ranks first in the production and export of grafted cactus in the world, exporting to more than 20 countries including the Netherlands, USA and Canada. Approximately 10 million grafted cacti, produced in Korea, are being