Fruit, Vegetable and Cereal Science and Biotechnology

Abbreviation: Fruit, Veg. Cereal Sci. Biotech.
Print: ISSN 1752-3419

Scope and target readership: *Fruit, Vegetable and Cereal Science and Biotechnology* provides a complete analysis and understanding of any aspects of fruit, vegetable, and cereal science and biotechnology.

Fruit, Vegetable and Cereal Science and Biotechnology primarily wishes to examine the following in fruits, vegetables and cereals:
1) *In vitro* propagation (micropropagation, somatic embryogenesis, tissue culture, bioreactor system production), tissue culture;
2) Mycorrhizal symbioses (and effects on plant physiology, productivity, reproduction and disease resistance);
3) Cultural practices (greenhouse growth, hydroponics, aeroponics, organic farming);
4) Physiology, genetics, molecular biology, structural botany (integrated, pure and applied);
5) Pathology;
6) Phytochemistry, organic and inorganic biochemistry;
7) Storage of genetic material (cold-storage or cryopreservation) and germplasm collections (*in vitro* and *in situ*);
8) Novel techniques for analysis (genetic, biochemical, biophysical).

For publication in *Fruit, Vegetable and Cereal Science and Biotechnology* the research must provide a highly significant new contribution to our understanding of fruit, vegetable and cereal crops (temperate, subtropical or tropical) and must generally be supported by a combination of either: physiological, biochemical, genetic or molecular analyses.

Global Science Books, Ltd.
46 Syon Lane, Isleworth, Middlesex
TW7 5NQ, United Kingdom

Editorial Office: Takamatsu, Japan
Accounting: Lagos, Portugal

GSB homepage: www.globalsciencebooks.com
GSB Japan: http://www17.plala.or.jp/gsbjapan

Printed in Japan on acid-free paper.

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Fruit, Vegetable and Cereal Science and Biotechnology, VOLUME 1, NUMBER 1, 2007

ABSTRACT

Special Feature: The cultivated strawberry (*Fragaria* × *ananassa* Duch.), a member of the *Rosaceae*, is the most important soft fruit worldwide. *In vitro* techniques are important for clonal multiplication, germplasm improvement and for gene conservation of this flavourful and nutritious berry crop. The *in vitro* propagation of *Fragaria* species using axillary bud proliferation, adventitious shoot regeneration and somatic embryogenesis has been investigated in a number of previous studies. The morphogenesis seems to be highly dependent on plant growth regulators and media used for culture, which is again genotype specific. In strawberry, genetic transformation has been developed using tissue culture systems with varying rates of success. This review presents the progress in-depth of various aspects of strawberry culture *in vitro*, on gelled and in liquid media using bioreactors, for its improvement and for commercial production. It also discusses the issues that still need to be addressed to utilize the full potential of plant tissue culture techniques in mass propagation, *in vitro* selection, somaclonal variation, haploid recovery, somatic hybridization, genetic transformation and in cryopreservation of strawberries. Application of molecular marker techniques should be useful to verify the clonal fidelity of micropropagated strawberries. Strawberry improvement using *in vitro* and molecular techniques will develop improved cultivars suited to the changing needs of growers and consumers.

ABSTRACT

Invited Review: Plant genetic resources for sustainable usage have been investigated as a basis for breeding programs for crop improvement and the advance of target gene(s) in genetic engineering. *Ex situ* conservation is used to preserve plant species manually in addition to *in situ* techniques. Orthodox seeds of temperate and subtropical species are mainly conserved as a genebank. However, methods of conservation of seedless and heterozygous orthodox tropical plant species and those with recalcitrant seeds are still limited. *In vitro* or live vegetative preservation is the preferred way to conserve elite species. There are many approaches to this, including short-, medium- and long-term preservation. Minimal growth *in vitro* culture or medium-term preservation has been widely exploited as a source of disease-free plants, which are promptly available for international material exchange. This technique is well established and is applied to a wide range of genetic conservation measures with high recovery growth and maintenance of genetic stability when compared to cryopreservation or long-term storage, identified by RAPD and AFLP genetic variation assay. Recently developed techniques and the application of minimal growth preservation will be described in this review. There are many techniques, which can be used to control the *in vitro* physical and chemical environments, including low temperature, low light intensity, short-photoperiod, high osmotic adjustment, low nutrient concentration and plant growth retardant supplementation for *in vitro* germplasm. In addition, the combination of both physical and chemical factors is a progressive channel, which can be used to develop general practices for medium-term preservation of tropical plant species.

ABSTRACT

Invited Review: Fruit yields depend on the successful achievement of a series of sequential processes from floral induction to fruitlet retention. For the successful set of an optimum crop load of most fruit cultivars, pollination and fertilization of flowers must be effective. In this paper, I describe the most commonly used methods for testing self-incompatibility and pollinator efficiency in the main fruit trees. Estimation of self-incompatibility can be done experimentally or genetically. Experimentally, comparisons following self- vs. cross- pollinations can be performed sequentially: (1) difference in fruit or seed sets; (2) different pollen germination and tube growth in the styles (self-incompatibility syndrome); (3) difference in ovule development (ovarian self-incompatibility) or cessation of embryo development after self-pollination (late-acting self-incompatibility). If seed set

differences are not explained by differences in these pre-zygotic steps, inbreeding depression can be responsible. The genetic approach of incompatibility with the characterization of S-alleles can assess the compatibility level between cultivars. Finally, pollination effectiveness and pollinator efficiency can be assessed with direct and indirect measures. Direct measures focus on pollen deposition and retrieval on virgin flowers. Indirect measures include pollinator guild, relative abundance and behaviour, pollen carryover capacity and gene flow.

ABSTRACT

Invited Review: African nightshades (*Solanum nigrum*-related species) are some of the most widely consumed traditional leafy herbs and vegetables, particularly in Africa and South-East Asia. The leaves contain high levels of vitamins (especially A, B and C), mineral fibres (such as iron, calcium and phosphorus), carbohydrates and proteins. They also contain phenolics and alkaloids, such as nicotine, quinine, cocaine, and morphine, which are known for their medicinal attributes. With the realization of their high nutritional, medicinal and health benefits, the demand for these vegetables has been on a rapid and steady rise in the recent years. However, due to very low leaf yields that are considered uneconomical compared to other high-yielding and high-value horticultural crops, production of these vegetables remains on a small scale. Prolific early flowering and excessive fruit- and seed-set, which compete with leaf production, are the main limiting factors on leaf yields. To eliminate or reduce fruit-set, hence competition with leaves, induction of male-sterility is probably one of the most immediate options. The main challenge that faces this strategy is propagation and maintenance of male-sterile lines. This review focuses on the mutation breeding for improved leaf yields of African nightshades with special reference to male-sterility. Aspects of propagation and maintenance of male-sterile lines are discussed.

ABSTRACT

Invited Mini-Review: Walnut, *Juglans regia* L. is the most economically important member of the *Juglandaceae* family and is the most valuable nut crop in the world. Recently, it has increased greatly in acreage and in production. Although a number of research programs about plant apomixis have been carried out around the world, few were representd by the *Juglandaceae*. This paper presents a brief review of the current status of knowledge in *Juglandaceae* plant apomixis research, especially in walnut, including chemicals induction, bagged isolation, observation of embryology, analysis of isoenzymes, physiological and biochemical characteristics of apomictic seedlings. We further introduce a strain which may be an obligate apomictic walnut, and discuss the problems associated with and the developmental prospects and progress in this field.

ABSTRACT

Original Research Paper: Micropropagated plantlets of *Vitis amurensis* Rupr. were used as rootstock and 'Jing Xiu' (*V. vinifera* L.) as scion. The effect of different graft methods *in vitro* on the survival rate for grafting and acclimatization of transplants was studied in this experiment. Results showed that the survival rate for grafted and acclimatized transplants by different graft methods differed greatly. Among eight micrografting methods, micropropagated *V. amurensis* Rupr. plantlets cultured for 30-40 d with or without roots and without leaves were selected as rootstock. Stem tips of 'Jing Xiu' *in vitro* for 20-30 d were selected as scion material. The survival rate for grafting was comparatively high, 90% for shoot tip/stem with roots and no leaves and 85% for shoot tip/stem without roots or leaves. Rootless and leafless stem segments used as rootstock, or stem tips and stem segments selected as scions demonstrated survival rates of acclimatized transplants higher than other graft methods used, 75% and 80%, respectively. The survival rate for transplants was 65% for shoot tip/stem with roots and no leaves, but it was lower than that of the two combinations of rootless rootstocks. This indicated that the physiological state of roots greatly affects the survival rate for transplanted, grafted plantlets. In order to increase grafted grapevine production and guarantee a higher survival rate, the perfect method for grape micrografting is proposed as: (1) plantlets with roots and without leaves as the rootstock, and a stem tip as the scion or (2) a stem segment without roots and leaves as the rootstock, and a stem tip as the scion.