

ORNAMENTAL CUT FLOWERS: POSTHARVEST TECHNOLOGY AND PHYSIOLOGY

Jaime A. Teixeira da Silva

Faculty of Agriculture, Kagawa University, Miki-cho, Ikenobe, 2393, Kagawa-ken, 761-0795, Japan,
Telfax: +81 (0)87 891 0747, E-mail: jaimetex@angelfire.com

REFERENCES

- Allison J. C. S., Williams H. T., Pammenter N. W. (1997). Effect of specific nitrogen content on photosynthesis of sugarcane. *Annals of Applied Biology*, 131: 339-350.
- Alscher R. G., Erturk N., Heath L. S. (2002). Role of superoxide dismutases (SODs) in controlling oxidative stress in plants. *Journal of Experimental Botany*, 53: 1331-1341.
- Altman S. A., Solomos T. (1993). 3-amino-1,2,4-triazole prolongs carnation vase life. *HortScience*, 28: 201-203.
- Altman S. A., Solomos T. (1995). Differential respiratory and morphological responses of carnations pulsed or continuously treated with silver thiosulfate. *Postharvest Biology and Technology*, 5: 331-343.
- Alvarez M. E. (2000). Salicylic acid in the machinery of hypersensitive cell death and disease resistance. *Plant Molecular Biology*, 44: 429-442.
- Beers E. P., Woffenden B. J., Zhao C. (2000). Plant proteolytic enzymes: possible roles during programmed cell death. *Plant Molecular Biology*, 44: 399-415.
- Bielecki R. L., Reid M. S. (1992). Physiological changes accompanying senescence in the ephemeral daylily flower. *Plant Physiology*, 98: 1042-1049.
- Bleecker A. B., Estelle M. A., Somerville S., Kende H. (1998). Insensitivity to ethylene conferred by a dominant mutation in *Arabidopsis thaliana*. *Science*, 241: 1086-1089.
- Buchanan-Wollaston V. (1997). The molecular biology of leaf senescence. *Journal of Experimental Botany*, 48: 181-199.
- Buckner B., Johal G. S., Janick-Buckner D. (2000). Cell death in maize. *Physiologia Plantarum*, 108: 231-239.
- Bulle A., de Jongh M. (2001). Effects of growing conditions on the shelf life of *Ficus benjamina*. *Acta Horticulturae*, 543: 113-117.
- Casadoro G., Trainotti L., Tomasin C. A. (1999). Expression of abscission-related endo- β -1,4-glucanases. *In*: Kanellis A. K., Chang C., Klee H., Bleecker A. B., Pech J. C., Grierson D. (Eds.). *Biology and biotechnology of the plant hormone ethylene II*. Kluwer Academic Publishers, Dordrecht: 243-247.
- Çelikel F. G., Dodge L. L., Reid M. S. (2002). Efficacy of 1-MCP (1-methylcyclopropene) and Promalin for extending the post-harvest life of Oriental lilies (*Lilium* x 'Mona Lisa' and 'Stargazer'). *Scientia Horticulturae*, 93: 149-155.
- Çelikel F. G., Reid M. S. (2002). Storage temperature affects the quality of cut flowers from the Asteraceae. *HortScience*, 37: 148-150.
- Chang A. Y., Gladon R. J., Gleason M. L., Parker S. K., Agnew N. H., Olson D. G. (1997). Postharvest quality of cut roses following electron-beam irradiation. *HortScience*, 32: 698-701.
- Chen J., Henny R. J., McConnell D. B., Nell T. A. (2001). Cultivar differences in interior performances of acclimatized foliage plants. *Acta Horticulturae*, 543: 87-96.
- Chen S. J., Hung K. T., Kao C. H. (1997). Ammonium accumulation is associated with senescence of rice leaves. *Plant Growth Regulation*, 21: 195-201.
- Conover C. A., Poole R. T. (1984). Acclimatization of indoor foliage plants. *Horticultural Reviews*, 6: 119-154.
- Cushman L. C., Pemberton H. B., Miller J. C., Kelly J. W. (1998). Interactions of flower stage, cultivar, and shipping temperature and duration affect pot rose performance. *HortScience*, 33: 736-740.
- Dai J., Paull R. E. (1991). Effect of water status on *Dendrobium* flower spray postharvest life. *Journal of the American Society for Horticultural Science*, 116: 491-496.
- Davies P. J. (1995). The plant hormones: Their nature, occurrence and functions. *In*: Davies P. J. (Ed.). *Plant Hormones: physiology, biochemistry and molecular biology*. Kluwer Academic Publishers, Dordrecht: 1-34.

- Drory A., Beja T. S., Borochoy A., Gindin E., Mayak S. (1995). Transient water stress in cut carnation flowers: effects of cycloheximide. *Scientia Horticulturae*, 64: 167-175.
- Druege U. (2001). Postharvest responses of different ornamental products to preharvest nitrogen supply: role of carbohydrates, photosynthesis and plant hormones. *Acta Horticulturae*, 543: 97-105.
- Druege U., Zerche S., Kadner R. (1998). Relation between nitrogen and soluble carbohydrate concentrations and subsequent rooting of chrysanthemum cuttings. *Advances in Horticultural Science*, 12: 78-84.
- Dubois P., Joyce D. (1992). Preservation of fresh cut ornamental plant material with glycerol. *Postharvest Biology and Technology*, 2: 145-153.
- Eason J. R., Johnston J. W., de Vré L. (2000). Reversal of glyphosate inhibition of *Sandersonia aurantiaca* flower senescence with aromatic amino acids. *Postharvest Biology and Technology*, 18: 81-84.
- Eckert M., Biela A., Siefritz F., Kaldenhoff R. (1999). New aspects of plant aquaporin regulation and specificity. *Journal of Experimental Botany*, 50: 1541-1545.
- Endo M., Ikusima I. (1997). Effects of CO₂ enrichment on yields and preservability of cut flowers in *Phalaenopsis*. *Journal of the Japanese Society for Horticultural Science*, 66: 169-174.
- Enzell C. (1985). Biodegradation of carotenoids - an important route to aroma compounds. *Pure and Applied Chemistry*, 57: 693-700.
- Estelle M. (2001). Proteases and cellular regulation in plants. *Current Opinion in Plant Biology*, 4: 254-260.
- Evans J. R. (1989). Photosynthesis and nitrogen relationships in leaves of C₃ plants. *Oecologia*, 78: 9-19.
- Evensen K. B., Olson K. M. (1992). Forcing temperature affects postproduction quality, dark respiration rate, and ethylene responsiveness of *Pelargonium x domesticum*. *Journal of the American Society for Horticultural Science*, 117: 596-599.
- Feng J., Barker A. V. (1992). Ethylene evolution and ammonium accumulation by tomato plants with various nitrogen forms and regimes of acidity. Part 1. *Journal of Plant Nutrition*, 15: 2457-2469.
- Ferrante A., Hunter D. A., Hackett W. P., Reid M. S. (2002). Thidiazuron - a potent inhibitor of leaf senescence in *Alstroemeria*. *Postharvest Biology and Technology*, 25: 333-338.
- Fjeld T. (1990). Effect of temperature and irradiance level on plant quality at marketing stage and the subsequent keeping quality of Christmas begonia (*Begonia x cheimantha* Everett). *Norwegian Journal of Agricultural Science*, 4: 217-223.
- Flores F. B., Martínez-Madrid M. C., Sánchez-Hidalgo F. J., Romojaro F. (2001). Differential rind and pulp ripening of transgenic antisense ACC oxidase melon. *Plant and Physiological Biochemistry*, 39: 37-43.
- Fukuda H. (2000). Programmed cell death of tracheary elements as a paradigm in plants. *Plant Molecular Biology*, 44: 245-253.
- Gan S., Amasino R. M. (1997). Making sense of senescence: molecular genetic regulation and manipulation of leaf senescence. *Plant Physiology*, 113: 313-319.
- Goddijn O., Smeekens S. (1998). Sensing trehalose biosynthesis in plants. *Plant Journal*, 14: 143-146.
- Gran C. D., Beaudry R. M. (1993). Determination of the low oxygen limit for several commercial apple cultivars by respiratory quotient breakpoint. *Postharvest Biology and Technology*, 3: 259-267.
- Han S. S. (2001). Benzyladenine and gibberellins improve postharvest quality of cut Asiatic and Oriental lilies. *HortScience*, 36: 741-745.
- Hansen J. D., Hara A. H., Tenbrink A. H. (1992). Vapor heat: a potential treatment to disinfest tropical cut flowers and foliage. *HortScience*, 27: 139-143.
- Hara A. H., Hata T. Y., Hu B. K. S., Tsang M. M. C. (1997). Hot-air induced thermotolerance of red ginger flowers and mealybugs to postharvest hot-water immersion. *Postharvest Biology and Technology*, 12: 101-108.
- Harbaugh B. K., Woltz S. S. (1989). Fertilization practice and foliar-bract calcium sprays reduce incidence of marginal bract necrosis of poinsettia. *HortScience*, 24: 465-468.
- Hartung W., Wilkinson S., Davies W. J. (1998). Factors that regulate abscisic acid concentrations at the primary site of action at the guard cell. *Journal of Experimental Botany*, 49: 361-367.
- Hayashi T., Todoriki S. (1995). Prevention of radiation-induced damage of chrysanthemums with vase solution. *Food Irradiation, Japan*, 30: 28-31.
- Hendriks L. (2001). Cultural factors affecting post-harvest quality of potted plants. *Acta Horticulturae*, 543: 87-96.
- Ichimura K., Kojima K., Goto R. (1999). Effects of temperature, 8-hydroxyquinoline sulphate and sucrose on the vase life of cut rose flowers. *Postharvest Biology and Technology*, 15: 33-40.
- Iwaya-Inoue M., Otsubo M., Watanabe G. (1999). Cellular water status in flower petals during senescence. *Cryobiology and Cryotechnology*, 45: 51-57.
- Iwaya-Inoue M., Takata M. (2001). Trehalose plus chloramphenicol prolong the vase life of tulip flowers. *Hort-*

- Science, 36: 946-950.
- Jeschke W. D., Peuke A. D., Pate J. S., Hartung W. (1997). Transport, synthesis and catabolism of abscisic acid (ABA) in intact plants of castor bean (*Ricinus communis* L.) under phosphate deficiency and moderate salinity. *Journal of Experimental Botany*, 48: 1737-1747.
- John I., Drake R., Farrell A., Cooper W., Lee P., Horton P., Grierson D. (1995). Delayed leaf senescence in ethylene-deficient ACC-oxidase antisense tomato plants: molecular and physiological analysis. *Plant Journal*, 7: 483-490.
- Jones R. B., Hill M. (1993). The effect of germicides on the longevity of cut flowers. *Journal of the American Society for Horticultural Science*, 118: 350-354.
- Jordi W., Pot C. S., Stoopen G. M., Schapendonk A. H. C. M. (1994). Effect of light and gibberellic acid on photosynthesis during leaf senescence of *Alstroemeria* cut flowers. *Physiologia Plantarum*, 90: 293-298.
- Jordi W., Stoppen G. M., Argiroudi I., In't-Velt E., Heinen P., van Toll H. (1996). Accumulation of a 50-kDA protein during leaf senescence of *Alstroemeria* cut flowering stems. *Physiologia Plantarum*, 98: 819-823.
- Joyce D. C., Meara S. A., Hetherington S. E., Jones P. (2000). Effects of cold storage on cut *Grevillea* 'Sylvia' inflorescences. *Postharvest Biology and Technology*, 18: 49-56.
- Kageyama Y., Shima K., Konishi K. (1995). Effect of calcium levels in culture solution on growth and cut flower quality of chrysanthemum. *Journal of the Japanese Society for Horticultural Science*, 64: 169-176.
- Karunaratne C., Moore G. A., Jones R. B., Ryan R. F. (1997). Vase life of some cut flowers following fumigation with phosphine. *HortScience*, 32: 900-902.
- Kaur N., Palta J. P. (1997). Postharvest dip in a natural lipid, lysophosphatidylethanolamine, may prolong vase life of snapdragon flowers. *HortScience*, 32: 888-890.
- Kawakami F., Soma Y., Tsutsumi T., Sato T., Yuge T., Yamamoto M., Komatsu H. (1996). Disinfestation of pests on cut flowers with gas mixtures of methyl bromide, phosphine and carbon dioxide. *Research Bulletin and Plant Protection Services, Japan*, 10: 39-46.
- Ketsa S. A., Piyasaengthong Y., Prathuangwong S. (1995). Mode of action of AgNO₃ in maximizing vase life of *Dendrobium* 'Pompadour' flowers. *Postharvest Biology and Technology*, 5: 109-117.
- Kim Y. S., Kim D., Hwang Y. S., Jung J. (1997). Chemical suppression of gravitropic bending response in flower stalks of snapdragon (*Antirrhinum majus* L.). *Agricultural Chemistry and Biotechnology*, 40: 567-571.
- Klock-Moore K. A. (2001). Post-production performance of impatiens plants grown in substrates containing compost. *Acta Horticulturae*, 543: 127-133.
- Knee M. (1996). Inhibition of *Petunia* flower senescence by 2,2 α -bipyridil. *Postharvest Biology and Technology*, 9: 351-360.
- Knee M. (2000). Selection of biocides for use in floral preservatives. *Postharvest Biology and Technology*, 18: 227-234.
- Koch K. E. (1996). Carbohydrate-modulated gene expression in plants. *Annual Review of Plant Physiology*, 47: 509-540.
- Koyama Y., Uda A. (1994). Storage and forcing methods of carnation cut at the bud stage. *Journal of the Japanese Society for Horticultural Science*, 63: 211-217.
- Ku V. V. V., Wills R. B. H., Leshem Y. Y. (2000). Use of nitric oxide to reduce postharvest water loss from horticultural produce. *Journal of Horticultural Science and Biotechnology*, 75: 268-270.
- Kuriyama H., Fukuda H. (2002). Developmental programmed cell death in plants. *Current Opinion in Plant Biology*, 5: 568-573.
- Kwack B. H., Suh J. N., Kim H. K. (1996). Effect of ethylene biosynthetic inhibitors on the vase life of cut *Cymbidium*. *Journal of the Korean Society for Horticultural Science*, 37: 141-145.
- Lee J. S., Kim Y. A., Sin Y. M. (1995). Effects of harvesting stage, preservative, and storage method on vase life and flower quality of cut snapdragon. *Journal of the Korean Society for Horticultural Science*, 36: 926-942.
- Lee J. S., Song C. Y., Wang H. J., Kim J. Y., Choi J. K., Kwack B. H. (1996). Effect of postharvest treatment and preservative solutions on flower quality and vase life of cut chrysanthemums. *Journal of the Korean Society for Horticultural Science*, 37: 136-140.
- Lee M. M., Lee S. H., Park K. Y. (1997). Effects of spermine on ethylene biosynthesis in cut carnation (*Dianthus caryophyllus* L.) flowers during senescence. *Journal of Plant Physiology*, 151: 68-73.
- Legé K. E., Cothren J. T., Morgan P. W. (1997). Nitrogen fertility and leaf age effects on ethylene production of cotton in a controlled environment. *Plant Growth Regulation*, 22: 23-28.
- Lelièvre J-M., Latche A., Jones B., Bouzayen M., Pech J-C. (1997). Ethylene and fruit ripening. *Physiologia Plantarum*, 101: 727-739.
- Lohr V. I., Pearson-Mims C. H. (1990). Damage to cut roses from fluoride in keeping solutions varies with cul-

- tivar. *HortScience*, 25: 215-216.
- Macnish A. J., Simons D. H., Joyce D. C., Faragher J. D., Hofman P. J. (2000). Responses of native Australian cut flowers to treatment with 1-methylcyclopropene and ethylene. *HortScience*, 35: 254-255.
- MacTavish H. S., Menary R. C. (2000). Production of volatiles in brown boronia flowers after harvest: pilot scale research. *Journal of Horticultural Science and Biotechnology*, 75: 455-458.
- Markhardt A. H., Harper M. S. (1995). Deleterious effects of sucrose in preservative solutions on leaves of cut roses. *HortScience*, 30: 1429-1432.
- Mathooko F. M. (1995). Regulation of ethylene biosynthesis in higher plants by carbon dioxide. *Postharvest Biology and Technology*, 7: 1-26.
- Matile P., Hörtensteiner S., Thomas H. (1999). Chlorophyll degradation. *Annual Review of Plant Physiology and Plant Molecular Biology*, 50: 67-95.
- Mayak S., Meir S., Ben-Sade H. (2001). The effect of transient water stress on sugar metabolism and development of cut flowers. *Acta Horticulturae*, 543: 191-197.
- McConchie R., Lang N. S., Lax A. R., Lang G. A. (1994). Reexamining polyphenol oxidase, peroxidase, and leaf-blackening activity in *Protea*. *Journal of the American Society for Horticultural Science*, 119: 1248-1254.
- Meir S., Droby S., Davidson H., Alsevia S., Cohen L., Horev B., Philosoph-Hadas S. (1998). Suppression of *Botrytis* rot in cut rose flowers by postharvest application of methyl jasmonate. *Postharvest Biology and Technology*, 13: 235-243.
- Ménard C., Dansereau B., Garelo G., le Page-Degivry M. T. (1995). Influence of nitrogen supply on ABA levels and flower senescence in *Rosa hybrida* cv. *Royalty*. *Acta Horticulturae*, 424: 151-153.
- Moe R., Fjeld T., Mortensen L. M. (1992). Stem elongation and keeping quality in poinsettia (*Euphorbia pulcherrima* Willd.) as affected by temperature and supplementary lighting. *Scientia Horticulturae*, 50: 127-136.
- Morgan P. W., Drew M. C. (1997). Ethylene and plant responses to stress. *Physiologia Plantarum*, 100: 620-630.
- Mortensen L. M. (1998). The influence of air humidity on growth and keeping quality of cut roses and some pot plants. Workshop on the influence of cultivation conditions of the keeping quality of ornamentals, Fyn, Denmark: 1-125.
- Mortensen L. M. (2001). Greenhouse climate and keeping quality of roses. *Acta Horticulturae*, 543: 199-205.
- Mueller R., Andersen A. S., Serek M., Stummann B. M. (2001). Physiological and genetic reasons for different postharvest characteristics in miniature potted roses. *Acta Horticulturae*, 543: 153-159.
- Nell T. A., Barrett J. E., Leonard R. T. (1989). Fertilization termination influences postharvest performance of pot chrysanthemum. *HortScience*, 24: 996-998.
- Nell T. A., Barrett J. E., Leonard R. T. (1997). Production factors affecting postproduction quality of flowering potted plants. *HortScience*, 32: 817-819.
- Nell T. A., Leonard R. T., Barrett J. E. (1998). Environmental factors affecting postproduction longevity. Workshop on the influence of cultivation conditions of the keeping quality of ornamentals, Fyn, Denmark: 1-125.
- Nielsen B., Starkey K. R. (1998). Response surface models of the effect of nutrients and spacing on the keeping quality of potted roses. *Acta Horticulturae*, 456: 215-221.
- Niyogi K. K. (2001). Photoprotection revisited: genetic and molecular approaches. *Annual Review of Plant Physiology and Plant Molecular Biology*, 50: 333-359.
- Nooden L. D., Guiamet J. J., John I. (1997). Senescence mechanisms. *Physiologia Plantarum*, 101: 746-753.
- Ohkawa K., Kasahara Y., Suh J. N. (1999). Mobility and effects on vase life of silver-containing compounds in cut rose flowers. *HortScience*, 34: 112-113.
- Otsubo M., Iwaya-Inoue M. (2000). Trehalose delays senescence in cut gladiolus spikes. *HortScience*, 35: 1107-1110.
- Pandey S., Ranade S. S., Nagar P. K., Kumar N. (2000). Role of polyamines and ethylene as modulators of plant senescence. *Journal of Bioscience*, 25: 291-299.
- Paull R. E., Chantrachit T. (2001). Benzyladenine and the vase life of tropical ornamentals. *Postharvest Biology and Technology*, 21: 303-310.
- Petridou M., Voyiatzi C., Voyiatzis D. (2001). Methanol, ethanol and other compounds retard leaf senescence and improve the vase life and quality of cut chrysanthemum flowers. *Postharvest Biology and Technology*, 23: 79-83.
- Poljakoff-Mayber A., Lerner H. R. (1994). Plants in saline environments. In: Pessarakli M. (Ed.). *Handbook of plant and crop stress*. Marcel Dekker Inc., New York: 65-96.
- Qadir A., Hashinaga F. (2001). Nitrous oxide inhibits *in vitro* growth of multiple postharvest fungi. *HortScience*, 36: 1302-1304.

- Ranwala A. P., Miller W. B. (2000). Preventive mechanisms of gibberellin₄₊₇ and light on low-temperature-induced leaf senescence in *Lilium* cv. *Stargazer*. *Postharvest Biology and Technology*, 19: 85-92.
- Reddy T. V. (1988). Mode of action of cobalt extending the vase life of cut roses. *Scientia Horticulturae*, 36: 303-314.
- Reddy A. R., Reddy K. R., Padjung R., Hodges H. F. (1996). Nitrogen nutrition and photosynthesis in leaves of pima cotton. *Journal of Plant Nutrition*, 19: 755-770.
- Reddy B. S., Singh K. (1996). Effects of aluminum sulphate and sucrose on vase life of tuberose. *Journal of the Maharajah Agricultural University*, 21: 201-203.
- Redman P. B., Dole J. M., Maness N. O., Anderson J. A. (2002). Postharvest handling of nine specialty cut flower species. *Scientia Horticulturae*, 92: 293-303.
- Reid M. S. (1985). Ethylene and abscission. *HortScience*, 20: 45-49.
- Richard C., Lincoln J. E., Bostock R. M., Gilchrist D. G. (2001). Caspase inhibitors reduce symptom development and limit bacterial proliferation in susceptible plant tissues. *Physiology and Molecular Plant Pathology*, 59: 213-221.
- Rubinstein B. (2000). Regulation of cell death in flower petals. *In: Lam E., Fukuda H., Greenberg J. (Eds.). Programmed cell death in higher plants. Kluwer Academic Publishers, Dordrecht: 59-74.*
- Satoh S., Mikami M., Kiryu S., Yoshioka T., Midoh N. (1999). Action of 1,1-dimethyl-4-(phenylsulfonyl) semicarbazide (DPSS), a new antisenescence preservative for cut carnation flowers. *In: Kanellis A. K., Chang C., Klee H., Bleecker A. B., Pech J. C., Grierson D. (Eds.). Biology and biotechnology of the plant hormone ethylene II. Kluwer Academic Publishers, Dordrecht: 441-442.*
- Seaton K. A., Joyce D. C. (1992). Gamma irradiation for insect disinfestation damages native Australian cut flowers. *Scientia Horticulturae*, 52: 343-355.
- Seaton K. A., Joyce D. C. (1993). Effects of low temperature and elevated CO₂ treatments and of heat treatments for insect disinfestations on some native Australian cut flowers. *Scientia Horticulturae*, 56: 119-133.
- Seaton K. A., Cook D. F., Hardie D. C. (1997). The effectiveness of a range of insecticides against western flower thrips (*Frankliniella occidentalis*) (Thysanoptera: Thripidae) on cut flowers. *Australian Journal of Agricultural Research*, 48: 781-787.
- Serek M. (1990). Effects of pre-harvest fertilization on the flower longevity of potted *Campanula carpatica* 'Karl Foerster'. *Scientia Horticulturae*, 44: 119-126.
- Serek M., Reid M. S., Sisler E. C. (1994). A volatile ethylene inhibitor improves the postharvest life of potted roses. *Journal of the American Society for Horticultural Science*, 119: 572-577.
- Serek M., Sisler E. C., Tirosh T., Mayak S. (1995). 1-Methylcyclopropene prevents bud, flower, and leaf abscission of Geraldton waxflower. *HortScience*, 30: 1310.
- Serrano M., Amorós A., Pretel M. T., Martínez-Madrid M. C., Romojaro F. (2001). Preservative solutions containing boric acid delay senescence of carnation flowers. *Postharvest Biology and Technology*, 23: 133-142.
- Shen Q., Ho T-H. D. (1997). Promoter switches specific for abscisic acid (ABA)-induced gene expression in cereals. *Physiologia Plantarum*, 101: 653-664.
- Shibuya K., Yoshioka T., Hashiba T., Satoh S. (2000). Role of the gynoecium in natural senescence of carnation (*Dianthus caryophyllus* L.) flowers. *Journal of Experimental Botany*, 51: 2067-2073.
- Shillo R., Ding M., Pasternak D., Zaccai M. (2002). Cultivation of cut flower and bulb species with saline water. *Scientia Horticulturae*, 92: 41-54.
- Shima K., Kageyama Y., Konishi K. (1995). Effect of magnesium levels in culture solution on growth and cut flower quality of chrysanthemum. *Journal of the Japanese Society for Horticultural Science*, 64: 177-184.
- Shimamura M., Ito A., Suto K., Okabayashi H., Ichimura K. (1997). Effects of α -aminoisobutyric acid and sucrose on the vase life of hybrid *Limonium*. *Postharvest Biology and Technology*, 12: 247-253.
- Smid E. J., de Witte Y., Gorris L. G. M. (1995). Secondary plant metabolites as control agents of postharvest *Penicillium* rot on tulip bulbs. *Postharvest Biology and Technology*, 6: 303-312.
- Son K. C., Gu E. G., Byoun H. J., Lim J. H. (1994). Effects of sucrose, BA, or aluminum sulfate in the preservative solutions on photosynthesis, respiration, and transpiration of cut rose leaf. *Journal of the Korean Society for Horticultural Science*, 35: 480-486.
- Spadaro D., Vola R., Piano S., Gullino M. L. (2002). Mechanisms of action and efficacy of four isolates of the yeast *Metschnikowia pulcherrima* active against postharvest pathogens on apples. *Postharvest Biology and Technology*, 24: 123-134.
- Starkey K. R. (1998). The effect of ammonium and calcium on the postharvest quality of potted roses. *Workshop on the influence of cultivation conditions of the keeping quality of ornamentals*, Fyn, Denmark: 1-125.
- Storey K. B. (1999). *Environmental stress and gene regulation*. Bios Scientific Publishers, Oxford, 514 pp.

- Swidzinski J. A., Sweetlove L. J., Leaver C. J. (2002). A custom microarray analysis of gene expression during programmed cell death in *Arabidopsis thaliana*. *Plant Journal*, 30: 431-446.
- Tanabe K., Dohino T. (1993). Responses of 17 species of cut flowers to electron beam irradiation. *Research Bulletin of the Plant Protection Services, Japan*, 10: 89-94.
- Tanigawa T., Kobayashi Y., Matsui H., Sakai Y. (1995). Effects of CO₂ enrichment on growth and vase life of cut flowers of *Dendranthema grandiflorum* (Ramat.) Kitamura. *Journal of the Japanese Society for Horticultural Science*, 64: 417-424.
- Tanigawa T., Kobayashi Y., Matsui H. (1997). Effect of CO₂ enrichment and day temperature on growth, flowering and cut flower quality in *Dendranthema grandiflorum* (Ramat.) Kitamura. *Environmental Control in Biology*, 35: 107-115.
- Teixeira da Silva J. A., Nhut D. T. (2003a). Thin cell layers (TCLs) and floral morphogenesis, floral genetics and *in vitro* flowering. *In: Nhut D. T., Le B. V., Tran Thanh Van K., Thorpe T. (Eds). Thin cell layer culture system: regeneration and transformation applications. Kluwer Academic Publishers, Dordrecht: 285-342.*
- Teixeira da Silva J. A., Nhut D. T. (2003b). Cells: functional units of TCLs. *In: Nhut D. T., Le B. V., Tran Thanh Van K., Thorpe T. (Eds). Thin cell layer culture system: regeneration and transformation applications. Kluwer Academic Publishers, Dordrecht: 65-134.*
- ten Have A., Woltering E. J. (1997). Ethylene biosynthetic genes are differently expressed during carnation (*Dianthus caryophyllus* L.) flower senescence. *Plant Molecular Biology*, 34: 89-97.
- ter Hell B., Hendriks L. (1994). Haltbarkeit von topfpflanzen über kulturmaßnahmen beeinflussbar. *TASPO Gartenbaumagazin*, 3: 12-14.
- ter Hell B., Hendriks L. (1995). The influence of nitrogen nutrition on keeping quality of pot plants. *Acta Horticulturae*, 405: 138-147.
- Thomas H. (1997). Chlorophyll: a symptom and a regulator of plastid development. *New Phytologist*, 136: 163-181.
- Thomas H., Howarth C. J. (2000). Five ways to stay green. *Journal of Experimental Botany*, 51: 329-337.
- Tian S., Xu Y., Jiang A., Gong Q. (2002). Physiological and quality responses of longan fruit to high O₂ or high CO₂ atmospheres in storage. *Postharvest Biology and Technology*, 24: 335-340.
- Todoriki S., Hayashi T., Nakamura Y., Kasamo K. (1994). Effects of gamma-irradiation on the activity of tonoplast H⁺-ATPase from potato tubers (*Solanum tuberosum* L.). *Plant and Cell Physiology*, 35: 829-836.
- Tyrach A. W. H. (1997). Inheritance of flower colour and flavonoid pigments in *Gerbera*. *Plant Breeding*, 116: 377-381.
- Tyerman S. D., Bohnert H. J., Maurel C., Steudle E., Smith J. A. C. (1999). Plant aquaporins: their molecular biology, biophysics and significance for plant water relations. *Journal of Experimental Botany*, 50: 1055-1071.
- Tyutyunnik V. I., Ponomaryova N. G. (1977). The change of essential oil content and quality depending on the conditions of storage and ways of preparations of the flowers of the rose. VII International Congress of Essential Oils, Kyoto, Japan: 221-223.
- Ueyama S., Ichimura K. (1998). Effects of 2-hydroxy-3-ionene chloride polymer on the vase life of cut roses. *Postharvest Biology and Technology*, 14: 65-70.
- Urban L., Jaffrin A., Brun R. (1995). Control of salinity in the rhizosphere of plants grown in soilless media. *Acta Horticulturae*, 408: 73-79.
- van der Meulen-Muisers J. J. M., van Oeveren J. C., Jansen J., van Tuyl J. M. (1999). Genetic analysis of post-harvest flower longevity in Asiatic hybrid lilies. *Euphytica*, 107: 149-157.
- van Doorn W. G., Cruz P. (2000). Evidence for a wounding-induced xylem occlusion in stems of cut chrysanthemum flowers. *Postharvest Biology and Technology*, 19: 73-83.
- van Doorn W. G., Abadie P., Belde P. J. M. (2002). Alkylethoxylate surfactants for rehydration of roses and *Bouvardia* flowers. *Postharvest Biology and Technology*, 24: 327-333.
- van Doorn W. G., Harkema H., Song J. S. (1995). Water relations and senescence of cut *Iris* flowers: effects of cyclohexamide. *Postharvest Biology and Technology*, 5: 345-351.
- van Doorn W. G., Hibma J., de Wit J. (1992). Effect of exogenous hormones on leaf yellowing in cut flowering branches of *Alstroemeria pelegrina* L. *Plant Growth Regulation*, 11: 59-62.
- van Doorn W. G., Veken M., Bakker M-L. (1994). Effect of dry storage on scape bending in cut *Gerbera jamesonii* flowers. *Postharvest Biology and Technology*, 4: 261-269.
- van Ieperen W., van Meeteren U., Nijse J. (2002). Embolism repair in cut flower stems: a physical approach. *Postharvest Biology and Technology*, 25: 1-14.
- van Meeteren U., van Gelder H. (1999). Effect of time since harvest and handling conditions on rehydration ability

- of cut chrysanthemum flowers. *Postharvest Biology and Technology*, 16: 169-177.
- van Meeteren U., van Gelder H., van Ieperen W. (2000). Reconsideration of the use of deionized water as vase water in postharvest experiments on cut flowers. *Postharvest Biology and Technology*, 18: 169-181.
- Walden R., Cordeiro A., Tiburcio A. F. (1997). Polyamines: small molecules triggering pathways in plant growth and development. *Plant Physiology*, 113: 1009-1013.
- Weller G. L., Graver J. E. S. (1998). Cut flower disinfestations: assessment of replacement fumigants for methyl bromide. *Postharvest Biology and Technology*, 14: 325-333.
- Wilkinson J. Q., Lanahan M. B., Clark D. G., Bleecker A. B., Chang C., Meyerowitz E. M., Klee H. J. (1997). A dominant mutant receptor from *Arabidopsis* confers ethylene insensitivity in heterologous plants. *Nature Biotechnology*, 15: 444-447.
- Williams M. H., Nell T. A., Barrett J. E. (1995). Investigation of proteins in petals of potted chrysanthemum as a potential indicator of longevity. *Postharvest Biology and Technology*, 5: 91-100.
- Wills R., McGlasson B., Graham D., Joyce D. (Eds.). (1998). *Postharvest: an introduction to the physiology and handling of fruit, vegetables and ornamentals* 4th ed. UNSW Press, Sydney, 483 pp.
- Yamane K., Kawabata S., Fujishige N. (1999). Changes in activities of superoxide dismutase, catalase and peroxidase during senescence of gladiolus florets. *Journal of the Japanese Society for Horticultural Science*, 68: 798-802.
- Zacarias L., Withelaw C., Grierson D., Roberts J. A. (1999). Physiological analysis of flower and leaf abscission in antisense-ACC oxidase tomato plants. *In: Kanellis A. K., Chang C., Klee H., Bleecker A. B., Pech J. C., Grierson D. (Eds.). Biology and biotechnology of the plant hormone ethylene II.* Kluwer Academic Publishers, Dordrecht: 381-386.
- Zavaleta-Mancera H. A., Franklin K. A., Ougham H. J., Thomas H., Scott I. M. (1999a). Regreening of senescent *Nicotiana* leaves I. Reappearance of NADPH-protochlorophyllide oxidoreductase and light-harvesting chlorophyll *a/b*-binding protein. *Journal of Experimental Botany*, 50: 1677-1682.
- Zavaleta-Mancera H. A., Franklin K. A., Ougham H. J., Thomas H., Scott I. M. (1999b). Regreening of senescent *Nicotiana* leaves II. *Redifferentiation of plastids.* *Journal of Experimental Botany*, 50: 1683-1689.