XII Postharvest Ornamental Symposium
Abstract book

		Day 1 (15-5-2023)		
08:30 - 10:00	1h30'	8:30 - 9:00 Opening 9:00- 9:30 Keynote Toine Timmermans 9:30 - 10:00 Keynote Ernst Woltering		
		chair Woltering		
10:00 - 10:30	**0h30'**	***break: Coffee & poster viewing***		
10:30 - 12:00	1h30'	Invited speakers: Innovations in postharvest technology and engineering Thijs Defraeye; Rick vd Zedde; Bart Nicolai		
		chair Verdonk		
12:00 - 13:30	**1h30'**	***lunch & poster session 1***		
time slot	**time allocated**	**Podium**	**Momentum 2+3**	**Momentum 1**
13:30 - 15:00	1h30'	PHU session 1a Invited: Pedreschi Physiology 1	PHU session 1b Postharvest Pathogens 1	PHO session 1 Invited: Celikel
		chair Brouwer	*Chair Gabriëls*	*Chair Schouten*
15:00 - 15:45	**0h45'**	***break: Coffee & poster viewing***		
15:45 - 17:15	1h30'	PHU session 2a Invited: Mishra Quality Measurements 1	PHU session 2b Storage and technology 1	PHO session 2 Invited: Fanourakis
		chair Nicolai	chair De Fraeye	*chair Celikel*
17:30 - 18:30		***business meeting Unlimited***		
		Day 2 (16-5-2023)		
09:00 - 10:15	1h15'	PHU session 3a Invited: Bovy Pre-harvest conditions 1	PHU session 3b Sensory & nutrition	PHO session 3 Invited: Arens
		chair Gabriëls	chair Langer	chair Fanourakis
10:15 - 11.00	**0h45'**	***break: Coffee & poster viewing***		
11:00 - 12:15	1h 15'	PHU session 4a Invited: Lukasse Logistics and modelling	PHU session 4b Pre-harvest treatments 1	PHO session 4
		chair Bovy	chair Arens	Chair Zepeda
12:15 - 14:00	**1h45'**	***lunch & poster session 2 & business meeting Ornamentals (momentum 1)***		
14:00 - 15:30	1h 30'	PHU session 5a Quality Measurements 2	PHU session 5b Physiology 2	PHO session 5 Invited: Verdonk
		chair Mishra	*Chair Farneti*	*chair Woltering*
15:30 - 17:00	1h 30'	Excursion NPEC/Phenomea/Unifarm	Excursion NPEC/Phenomea/Unifarm	Excursion NPEC/Phenomea/Unifarm
19:00 - 22:30		***Conference dinner WICC***		
		Day 3 (17-5-2023)		
09:00 - 10:30	1h30'	PHU session 6a Invited: Farnetti Physiology 3	PHU session 6b Preharvest conditions 2	PHU session 6c Postharvest Pathogens 2
		chair pedreschi	chair van de Zedde	chair Verschoor
10:30 - 11:00	**0h30'**	***break : Coffee & poster viewing***		
11:00 - 12:30	1h30'	PHU session 7a Quality Measurements 3	PHU session 7b Postharvest treatments 1	PHU session 7c Chilling and disorders 1
		chair Lukasse	chair Singh	chair Affandi
12:30 - 14:00	**1h30'**	***lunch & poster session 3***		
14:00 - 15:00	1h30'	PHU session 8a Chilling and disorders 2	PHU session 8b Packaging and coating 1	PHU session 8c Storage and technology 2
		chair Ferrante	chair Paillart	chair Pedrotti
15:00 - 15:30	**h30'**	***break: Coffee & poster viewing***		
15:30 - 16:30	1h30'	PHU session 9a Packaging and coating 2	PHU session 9b Postharvest treatments 2	PHU session 9c Storage and technology 3
		chair Beaudry	*chair Campos vargas*	chair Wood
16:30 - 17:00	0h30'	***Closing of the Symposium***		
17:00 - 18:00		***Farewell drinks***		

VII Postharvest Unlimited
ISHS International Conference
14-18 May 2023 - Wageningen, NL

XII Postharvest Ornamentals
ISHS International Symposium
14-16 May 2023 - Wageningen, NL

Session PHO1-i

Preharvest and postharvest factors in sustainable quality management of ornamental plants

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Abstract

Other than genetics, we know all cultural practices and environmental conditions during production may greatly determine the postharvest quality and longevity of ornamental plants. We are only able to maintain the high quality obtained by proper cultivation under optimum ecology. Unfortunately, we lose a significant part of the produced cut flowers/greens and pot plants after harvest. The lost product has a huge carbon footprint. Care is the most sustainable factor in quality management to prevent postharvest losses since it needs no energy resource. However, the most important postharvest factor in maintaining quality and preventing losses of perishable crops is temperature. At low temperature, not only ageing processes and fungal development are greatly suppressed, but also negative gravitropic bending is eliminated. Besides, there is no need storing or transporting the flowers in solution/water at low temperature. Therefore, the living products that are not sensitive to chilling injury should be stored and transported at temperature close to 0°C to keep them fresh from grower to consumer. However, lower temperatures mean more energy to use. Thus, sustainable cooling and transport are needed for sustainability to reduce energy used. Eco-friendly treatments are another important issue in the sustainability of the flower industry. After harvest, cut flowers and pot plants are commonly treated with a range of compounds to prolong the postharvest life. Ecofriendly and sustainable sprays or pulsing and vase solutions such as natural extracts from medicinal plants should be preferred as a biocide in solutions to maintain the postharvest quality of cut flowers/greens and pot plants. Ethylene is a problem for sensitive cut flowers and plants. 1-Methylcyclopropene is an ecofriendly alternative to the commonly used silver thiosulphate. Disease life cycle and triangle should be considered in postharvest control strategies to avoid using harmful chemicals. Biodegradable recyclable packaging materials and sustainable coatings should be preferred to reduce plastic waste. As conclusion, sustainable quality management of flower chain from grower to consumer can reduce postharvest losses contributing to the sustainability of the value chain.

Extended vase life treated with glucose was caused by high evapotranspiration rate in cut sweet pea flowers

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Abstract

Sweet pea (Lathyrus odoratus L.) has wide range of flower color and great fragrance. However, the short vase life limits commercial potential. Our previous study revealed that glucose treatment improved water uptake and extended the vase life of cut sweet pea flowers (Acta Hortic. 1283, 27-32). The vase life of cut flowers treated with sucrose or glucose solution was 7 and 9 days, respectively. From 3 days after harvest, solution uptake was only decreased by sucrose treatment. However, the detailed mechanism how glucose improved water uptake is still unclear. Many previous studies have estimated the evapotranspiration of cut flowers from weight changes, however no studies have directly measured H 2 O released from flowers into the atmosphere. To clarify the evapotranspiration of cut flowers, we equipped a H 2 O gas analyzer. The STS treated cut sweet pea flowers were placed in 40 g L -1 (117 mM) sucrose or 21 g L -1 (117 mM) glucose solutions, both with 200 mg L -1 8-HQS and held in a plant growth incubator at 23°C with 70% relative humidity, under 20-40 μmol m -2 s -1 photon flux density and 12 h light photoperiod. Evapotranspiration of cut flowers was measured using H 2 O gas analyzer (LI-840 CO 2 /H 2 O Gas Analyzer, LI-COR). Glucose treatment kept significantly high evapotranspiration rate of cut sweet pea flowers. It results in high solution uptake by glucose treatment. In many previous studies, a low evapotranspiration rate was key to maintaining water balance. In this study, we clarified a case in which a high evapotranspiration rate improved the water condition of petals. We conclude that glucose treatment kept high evapotranspiration rate with high solution uptake and subsequent water condition of petals was improved, consequently vase life of cut sweet pea flowers was extended.

Session PHO1-2

Carbohydrate depletion causes rapid leaf necrosis in cut Chrysanthemum

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Abstract

Chrysanthemums are the second-largest exported cut flower worldwide for their variety of shapes, colors, and forms; however, the leaves of some commercial cultivars exhibit rapid leaf necrosis during the first week in the vase. This characteristic severely impacts consumer perception of plant quality. Thus, this problem is a primary concern for growers, and the causes of this phenomenon are not known. Two experiments were performed in other to identify the cause of rapid leaf necrosis in cut chrysanthemum leaves commercially grown in Colombia and shipped to Clemson University for vase life evaluation. The first experiment evaluated the leaf performance of Chrysanthemum 'GreenScreen', 'Bomber Green', 'Peridot' and 'Shrek' grown with two flower forms: one flower per stem (disbud) vs. 8-10 flowers per stem (spray). Stems with spray form showed leaf necrotic symptoms while stems with disbudded forms showed good quality leaves after 10 days. This result can be related with sink-source dynamics. Spray stems depleted carbohydrate in leaves due to high sink demand resulting in rapid leaf necrosis, while disbud stems had lower sink demand resulting no leaf necrosis. The second experiment evaluated the effect of sucrose concentrations in the vase solution following shipping. Stems of Chrysanthemum 'Paintball sunny', 'Mark Twain', 'WhatsApp', ' Peridot', 'Shrek' and 'Bomber Green' were placed in vases with a solution of 0%, 10% or 20% sucrose. Stems with 0% sucrose in the vase solution presented severe leaf necrotic symptoms after 2 days, while stems with 10% or 20% sucrose presented very low levels of leaf necrosis or no symptoms after 10 days. Together, the results from both experiments suggest that the rapid leaf necrosis of chrysanthemum is related with carbohydrates depletion in the leaves during postharvest.

Session PHO1-3

Edible Petunia, the next gourmet garnish?

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Abstract

Consumers demand high-quality and diverse produce. The emergence of new exclusive foods such as finger limes, cape gooseberries, and pansies appear in new dishesmnot only for their nutritional value but also as a garnish. In the coming years, edible flowers are expected to attract more attention. However, in some cases, the potential harmfulness of flowers can prevent some species from being ediblemmembers of the Solanaceae family produce highly toxic compounds. For example, tobacco and Atropa belladonna have alkaloids with different degrees of toxicity when ingested. Petunia would be an excellent candidate for gourmet garnish. It makes high numbers of colorful flowers with a good postharvest life. However, for petunia flowers to be used as food, it is essential to test if they are harmless for human health. Alkaloid concentrations can be influenced by environmental factors such as biotic or abiotic stresses. Soil and water salinity are among the most devastating abiotic stresses that significantly affect crop quality and productivity. Still, salinity treatments can also improve tomato quality, however negatively affecting growth and yield. As petunias are potentially edible, salinity treatment could also affect flower quality. Preliminary results indicate the presence of alkaloids in petunia flowers in normal growth conditions. Therefore, petunias were grown under salinity treatments and then analyzed at harvest and seven days after cold storage to assess nutritional values and toxicity levels. For flowers, membrane integrity and Vitamin C content were studied to evaluate the balance between potential oxidants and antioxidants. Ion leakage decreased after seven days in cold storage compared to at harvest for salinity treatments. At the same time, the Vitamin C content decreased after cold storage for all flowers. Further analyses include alkaloids characterization and volatile measurements to assess toxicity levels and quality traits under salinity treatments of flowers.

Postharvest application of Pyrimethanil by Smoke Generator (FRUITFOG(r)-PYR) to control Botrytis cinerea on cut flowers of Colombia

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Abstract

In Colombia, cut flowers are the main export market and it is the largest producer and exporter of carnations worldwide. The main fungus which affects flowers during its transit and marketing is Botrytis cinerea (BC). BC is a widespread disease of farmhouse-grown flowers. Sanitation, cultural practices, and chemical control using authorized fungicides have been the main recommendations for reducing infection in flowers production. The problem is aggravated by latent infections that are symptomless at harvest but become apparent during storage and transport. Postharvest applications of a recommended fungicides such as pyrimethanil has proven to be effective in controlling BC. This study shows the effect of a postharvest application of pyrimethanil with a smoke generator formulation (FRUITFOG ® -PYR) on the reduction of BC inoculum load, present in the cold rooms that contain handled cut-flower. During different seasons, in several flower varieties, different scanning of the environmental contamination of BC spores in the cold rooms were carried out, before and after the fogging application, with the help of SMB-Petri dishes. Based on the results of these mappings, FRUITFOG ® -PYR reduces the presence of BC colonies in the cold rooms. On the other hand, preliminary tests were carried out to evaluate the efficacy of the smoke generator over the incidence of BC disease on three rose cultivars. For it, four treatments were compared 1) Control (CTL) (flower with BC); 2) PYR (flower with BC treated after with FRUITFOG ® -PYR); 3) CTL-AI (flower without BC infection but artificially inoculated with BC); 4) PYR-AI (flower without BC infection treated with FRUITFOG ® -PYR and after artificially inoculated with BC). In all cases the fogging application showed preventive and curative control capacity over BC incidence. Therefore, it can be concluded that FRUITFOG ® -PYR can be a useful tool to improve the fungicidal handling in the cut flowers postharvest.

A framework for identifying horticultural and breeding strategies for longer vase life

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Abstract

Consumer satisfaction relies on long vase life. In real-world situations, cut flower wilting is a major symptom terminating vase life. It depends on (1) the water balance and (2) the water potential threshold at which tissue (flower, leaf, or stem) cells lose turgor. Water balance is further a function of loss (I) and uptake (II) of water. Regrettably, these four traits have not been simultaneously evaluated within or across cut flower species. Therefore, the relative importance as well as potential relationships or general patterns remain unknown. Growing evidence suggests that environmental conditions during plant growth affect the stomatal regulation of water loss, while relevant studies on the remaining traits are scant. Enhanced rates of water loss owing to attenuated stomatal functionality intensify the incidence of wilting. This negative effect may be maximized or remain unnoticed depending on other postharvest conditions. Within a given genotype, stomatal closing ability and anatomy have not been related. Stomatal anatomy (density, size) are set during leaf development. Instead, stomatal functioning may be disturbed by specific conditions not only during plant growth, but also across the supply chain. Importantly, recent work abandons the idea that non-leaf tissues are an insignificant contributor to cut flower water loss. Simultaneous analysis of associated traits along with the respective effects of the growth environment comprises a valuable context for improving vase life.

Session PHO2-1

Pulse-treatments with thidiazuron and melatonin improve quality and prolong vase-life of Ranunculus asiaticus L. cut flowers

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Abstract

The buttercup (Ranunculus asiaticus L.), belonging to Ranunculaceae family, is a popular ornamental plant in the Mediterranean area, cultivated and sold as cut flower and potted plant. Loss of post-harvest ornamental value in R. asiaticu s L. commodities/product is mainly related to senescence process which appear first in the leaves (yellowing) and subsequently affects the flower (wilting and abscission). Its vase life is quite short and ranges from 9 to 11 days, depending on postharvest conditions. In these experiments, the effects of thidiazuron (TDZ), a synthetic cytokinin and melatonin (MEL), a recently discovered phytohormone was investigated on post-harvest longevity of cut buttercup flowers. Cut flowers were pulse treated with water (control), 10 µM TDZ and 100 µM MEL. All treatments were applied for 24 h (pulse). The effect of treatments was then evaluated by water balance relations, chlorophyll content, chlorophyll a fluorescence, vase life and ethylene production. The water balance relations showed the highest values in TDZ and MEL-treated cut flowers. The photosynthetic performance in the control cut flowers exhibited a strong downregulation, whereas the TDZ and MEL treated ones maintained the leaves vitality throughout the experimental timing. The leaf chlorophyll content and ethylene production were both higher in TDZ and MEL treated plant compared to non-treated plant. Both TDZ and MEL treatments showed an improvement of cut flower vase-life. These results suggested that a single 24-h pulse treatment with 10 µM TDZ or 100 µM MEL significantly delayed the progression of senescence process in cut buttercup flowers for more than 18 days.

Session PHO2-2

Floral preservative improves the tolerance of Eustoma grandiflorum susceptible cultivars to methyl bromide fumigation

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Abstract

Lisianthus (Eustoma grandiflorum) ranks the third place of exported cut flowers in Taiwan. The major export market is Japan followed by Australia. The competition with other countries in the international floral market is intense, but there is limited research about the effects of methyl bromide fumigation, that is a common quarantine method required by local government for imported plants, on postharvest qualities of cut lisianthus. In order to maintain lisianthus quality after arrival at export market, we need to know the changes of postharvest qualities of lisianthus after methyl bromide fumigation. Three cut lisianthus with floral preservatives or tap water were fumigated with methyl bromide 32 g·m-3 for 2 hours after 48 hours shipping simulation, and then the qualities of cut lisianthus during the vase period were investigated. The vase life of three varieties after fumigation treatment was similar to non-fumigated cut lisianthus, even slightly increased. However, fumigation treatment affected the opening of the cut lisianthus buds. The opening rate of the first buds was significantly reduced by 20% to 30%, especially the variety 'Celeb green' had obvious injuries with the surface of the stems shrinks, and the pedicels of flowers dried out. Also, the opening diameter of the first buds decreased 1 ~ 1.5cm. As a result, the quality of flowers after fumigation quarantine decreased significantly. However, floral preservatives treatment could maintain the quality of cut lisianthus after fumigation. The vase life of lisianthus treated tap water were about 7 ~ 8 days compared to vase life of flowers at commercial preservatives were about 9 to 11. Adding sucrose into the commercial preservative significantly improved postharvest qualities of lisianthus. The different varieties had different sensitivity to methyl bromide fumigation. Therefore, to have good customer feedback of export market, it is recommended to choose fumigation-tolerant varieties and apply preservatives during shipment for a better postharvest quality after fumigation.

Session PHO2-3

Novel strategies to enable breeding for increased resistance to post harvest pathogens

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Abstract

Within Wageningen University and Research, we aim to exploit the biodiversity in Capsicum (pepper) and Rosaceae (strawberry and roses), to unravel the genetic mechanism of resistance against respectively Phytophthora capsici and Botrytis cinerea. Both these pathogens cause severe disease symptoms in greenhouses, open-field and even upon post harvest transport or storage. There is a need for more resistant varieties to reduce losses and decrease chemical use in production as well as in postharvest storage and distribution. Besides defense mechanisms which are based on presence of multiple R genes, a novel strategy to obtain resistance is observed in varieties with mutations in plant S (susceptibility) genes. Functional mutations in S genes turn a host plant into a non-host, leading to broad spectrum resistance to all pathogen species requiring presence of that specific S gene. Within a consortium of plant breeding partners, we aim to identify putative S genes in our target crops. A number of S genes required for pathogenicity of Phytophthora and Botrytis have already been identified in Arabidopsis thaliana and in several crops like lettuce, potato and tomato. We aim to identify the orthologs of these known S genes in our target crops. Allele mining will be used to investigate presence of S gene mutants among the core collections available at Wageningen Plant Breeding and among interesting sources from the participating companies. Increased knowledge of the pepper - P. capsici and Rosaceae-Botrytis interactions might also be useful for breeding for resistance in other complex host-pathogen systems.

Session PHO2-4:

Open slot

Session PHO3-i

Genetic analyses for resilience against Botrytis cinerea in gerbera and rose

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Abstract

Botrytis cinerea is a problematic post-harvest pathogen as postharvest conditions can be very favourable for its infection and growth process leading to detrimental effects on cut-flowers. Next to technical measures to reduce losses, breeding for more resistant cultivars would be another option to counteract the problems caused by B. cinerea in crops . However testing for botrytis is quite tedious as there is often high environmental variation involved in these tests and multiple loci are involved in resilience. Thus repeated testing with relatively high numbers of samples is required to obtain reliable overall scores of higher resistant plants. Finding association of such a complex trait with DNA markers would allow pre-screening for favourable alleles in breeding programs to increase the resilience to botrytis by marker assisted breeding and reduce number of plants in disease testing. This kind of QTL- mapping can be done in several ways and two different approaches will be presented, one for gerbera and the other for rose.

Session PHO3-1

NaOCl treatments before shipment prevent Botrytis cinerea infection in potted roses

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Abstract

Botrytis cinerea infection is a common problem for commercial growers of potted miniature roses (Rosa hybrida L.), especially after packaging and transporting in humid conditions to consumers. Growers need environmental friendly and sustainable solutions to this significant matter which causes quality loss for their products. That is why, we investigated the efficiency of different concentrations of sodium hypochlorite (NaOCl) treatments as spray or dip after harvest (production) at different maturity, 1- 5 days before shipment (DBS). Spray applications of NaOCl at 200 µL·L -1 3 days before shipment dramatically reduced Botrytis cinerea infection of flowers and buds in miniature rose plants. Repeated sprays at 3+2 DBS significantly increased the efficacy of the NaOCl treatment and an additional application (3+2+1 DBS) completely eliminated infection. Spray applications were as effective as dipping the plants.

Detection and Prediction of Gray Mold Disease and Longevity of Cut Flowers Using Hyperspectral Imaging and Deep Learning Techniques

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Abstract

The longevity of cut rose flowers is one of the most important factors for customer satisfaction and repeat purchases. Water stress, ethylene damage, and gray mold disease caused by Botrytis cinerea (B. cinerea) during postharvest storage and transportation are major factors that affect the vase life of cut roses. In this study, we developed a non-contact measurement technique for detecting and predicting B. cinerea infection and postharvest quality of cut roses during exportation based on hyperspectral images (HSI) and the corresponding prediction model using deep learning techniques. Cut rose flowers were held in dry or wet transport conditions and were exposed to ethylene (2 μL L -1) every 12 h or inoculated with B. cinerea (10 5 conidial mL -1) during exportation simulation. HSI of cut roses is derived with a spectrum ranging from 450 to 900 nm for analysis of the disease infection and quality of cut flowers. The acquired HSI based on gray mold disease infection and changes in the quality of cut flowers were collected and used to build the dataset. YOLOv5 models, object detection with high performance, were used for gray mold disease detection in cut roses. The results showed that the spectrum wavelength at 680 nm and 900 nm were optimal for early gray mold disease detection and changes in the postharvest quality of cut roses. Additionally, YOLOv5 achieved an object detection mAP of 83.27% for B. cinerea infection in cut roses. These results show that HSI is an effective technique and a practical method for detecting early B. cinerea infection and predicting changes in the postharvest quality of cut flowers.

Roles of Ethylene in Regulating the Susceptibility of Cut Roses to Botrytis cinerea

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Abstract

Botrytis cinerea (B. cinerea) is a necrotrophic pathogen that causes significant growth and postharvest commercial losses in cut roses. Postharvest disease severity is affected by ethylene levels during transport and storage conditions. In this study, we identified the relationship between ethylene, fungal growth, and ethylene inhibitors during B. cinerea infection in cut 'Pink Beauty' roses. The results suggest that cut rose susceptibility to gray mold disease is associated with the developmental stage of flowers, especially the level of senescence, which is stimulated by ethylene biosynthesis in petals. The mRNA levels of ethylene biosynthesis genes in petals were related to the severity of gray mold; however, their expression levels decreased when the cut roses were completely macerated by B. cinerea . B. cinerea infections in cut flowers activated ethylene biosynthesis and signaling pathways, activating RhERFs in the petals. Ethylene regulated the development of B. cinerea infections in the cut flowers directly by binding to the receptors or indirectly by promoting the ethylene response in the host tissues. The suppression of ethylene responses in petals and inhibition of the fungal histidine kinase receptor of B. cinerea by 1-methylcylopropene (1-MCP) made cut rose flowers resistant to such necrotrophic pathogens. We also established a working model for ethylene binding and plant and fungus actions in the rose- B. cinerea pathosystem. Understanding the relationship between ethylene and gray mold disease in cut roses and the interaction between ethylene inhibitors and B. cinerea will help improve postharvest treatments for reducing B. cinerea damage in cut flowers.

Deep learning based lily bulb classification from multiple camera views

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Abstract

The Lily (Lilium spp.) is an important bulbous plant as cut flower species. To produce marketable lily flowers, high-quality lily bulbs are required from growers. Depending on the size, shape , and other characteristics, the bulbs may have varied economic value. The factor that reduces the quality of the bulb and consequently reduces customer satisfaction is the occurrence of "double-nosed" and "defected" bulbs. Recognizing them during the processing is a laborious and time-consuming task. Therefore, an accurate vision system to classify and analyze the bulbs in real time is critical. In this paper, we describe the results of our study on building a deep learning - based model for lily bulb classification. We use a custom - made system for data collection. It compris es 9 cameras for imaging the bulbs from multiple sides. We utilize the pre-trained EfficientNet deep learning model as the backbone and train multi - view Convolutional N e ural N etwork (CNN) on various combination s of camera views . Then , based on the performance , we propose the best combination of camera views to be used in building the sorting machine. An accuracy of 97 % was achieved during the experimental study.

Session PHO4-2

Development of Innovative Tools for Understanding Postharvest Senescence in Ornamental Vegetables

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Abstract

Ornamental vegetables such as broccoli, cauliflower, and artichoke are multitude of colorful and attractive vegetables and invaluable for human health, but their quality deteriorates during distribution before reaching consumers due to ongoing biochemical processes and compositional changes. The current lack of any objective indices for defining " freshness " of vegetables limits our capacity to control product quality and leads to food loss and waste. In this work, we undertook interdisciplinary research to address plant science challenges related to plant maturation and postharvest senescence. It is leveraging plant physiology, genomics and gene-editing tools, and machine learning technologies to understand deterioration of ornamental vegetables. We therefore propose a comprehensive research program to identify genes, proteins, and compounds as "freshness-indicators" and to aid development of an innovative and easy-to-use accessibility tool to accurately estimate the freshness of produce. The goal of the proposed research will advance in both basic research and applied science. Such toolkits would allow a new level of postharvest logistics, supporting availability of high-quality, nutritious, extended shelf-life of fresh produce.

To a sustainable cultivation system for chrysanthemum: effect of light spectrum on flower production and quality

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Abstract

Light is one of the most important environmental factors in horticulture affecting plant growth and development and the quality of the harvestable product. In northern latitudes, light levels during winter periods are insufficient to maintain production levels and product quality, due to the low light intensities and short photoperiods. Therefore, natural light is supplemented by assimilation lamps, with high pressure sodium lamps (HPS) currently being the predominant greenhouse lighting source. However, in the last decade, interest in LED lighting has increased considerably in vegetable and ornamental cultivation. In chrysanthemum, there are specific concerns on maintaining the quality of the harvestable product under LED lighting, especially when it comes to realizing the desired stem length. Therefore, experimental research was conducted to determine the effects of spectral composition of the light on stem length and plant quality in chrysanthemums cut flowers. Four chrysanthemum varieties were grown under winter conditions under LED lighting supplementing the available sunlight. A range of spectral compositions was applied which differed primarily in the proportion of blue and far-red light. Growth and development of chrysanthemum was monitored during cultivation. Flowers were harvested when having 4-5 open flowers, and flower quality was determined. The results showed that chrysanthemums can be grown well under full LED. Stem length was primarily affected when the day was extended for 30 minutes with 20 µmol/m2/s far red light (EOD, end of day treatment). Stem elongation was already observed after two weeks, and resulted in longer flowering shoots, as well as a faster cultivation cycle, under conditions which have an electricity demand that is 50% reduced compared to the traditional HPS lighting sources. These results indicate that quality of cut flowers can be controlled in a sustainable way.

Stomatal behaviour in wilting chrysanthemum leaves

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Abstract

In chrysanthemum cut flowers, leaf wilting is one of the main factors determining vase life. In this study, we modelled the dynamics of stomatal closure as response to leaf desiccation for three chrysanthemum cultivars (Saffina, Bellavista and Ofir). Chrysanthemum stems were recut (40 cm) and rehydrated for one day in either high or low relative humidity or in low relative humidity with abscisic acid sprayed on the leaves. We recorded weight loss every ten minutes during a two hour desiccation period. Each treatment consisted of six leaves with one leaf (third leaf from the top) detached per stem. During this two hour period also stomatal width and density were quantified for three additional leaves per treatment. Results show that the transpiration rate coincides with the change in stomatal width, and that the stomatal width first increases and then decreases. We created a kinetic model assuming four simultaneous occurring processes in the desiccated leaves (water loss through the cuticula and closed stomata (1), water loss through the open stomata (2), stomatal closure (3) and finally, irreversible closure of the stomata (4)). Taking into account the large variation in the initial weight of the leaves, the model explains between 91 and 93% of the observed behaviour. Treatment effects were mostly concentrated on the rate constant describing water loss through the open stomata. The rate of water loss through the cuticula was cultivar dependant. Currently, we are in the process of applying this transpiration model to quantify wilting behaviour of desiccated leaves that are pre-treated at different relative humidity levels, cold storage times and time on the vase. We are also investigating the relation between the behaviour of desiccating leaves and the performance of whole stems during the vase life.

Session PHO4-5

Effector proteins of Botrytis elliptica as tools for resistance breeding in lily against fire blight disease

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Abstract

No abstract available

Session PHO5-i

Carbohydrates, Fuel for storage?

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Abstract

Chrysanthemum cut flowers are known for good postharvest quality: long vase life, and often storability for extended periods of time. Long storage is essential for cut flowers to be transported by sea freight instead of air. It is a sustainable solution for the trend to grow cut flowers in regions around the equator. During this transport, cut flowers are exposed to harsh abiotic conditions: low temperature, draught, and darkness for periods up to 5 weeks. This variation in storability provides the opportunity to identify mechanisms that confer good postharvest storability, and potential markers for breeding.

Senescence and sugar starvation have been shown to be important for postharvest quality. In addition, carbohydrates in the vase water can lead to reduced vase life because of bacterial growth in the vase water. The importance of carbohydrates for long storability was investigated. We used preharvest conditions and a selection of genotypes to vary initial carbohydrate levels. Flower stems were subjected to storage conditions (cold, dry, dark) for 3 weeks and subjected to vase life, which was compared to that of non-stored flower stems. For vase life analysis, fresh weight was determined over time. Carbohydrates were analysed in vase water, stems, and flower tissues.

We found that sugar leakage in the vase water of carbohydrates that have accumulated in stems can be increased by cold storage, but this is not the case in all genotypes. Our experiments indicate that during storage, complex sugars are converted in simple ones, and that the initial level of complex sugars are important for a good vase life, and possibly for storability. However, right now conflicting results in other genotypes prevent us to understand the exact mechanism. This work provides insights to improve long storage of flowers, and more sustainable transport.

Session PHO5-1

Postharvest issues in tropical flowers

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Abstract

No abstract available

Posters ornamentals

Chrysanthemum yield increased using targeted foliar fertilizer applications

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Abstract

Fertilizer has traditionally been applied to the soil, and plants have obtained the nutrients they require from the soil via the roots. There has been previous research that shows foliar nutrition can work in tandem with soil fertilization, or even replace it. Traditionally, chrysanthemum (Dendranthema grandiflorum) production in Columbia has only applied nutrients via the soil. This worked aimed to assess the agronomic and economic benefits of supplementing the edaphic fertilisation with foliar fertilisation. The work looked at four liquid fertilizers: Albina containing calcium; Indra that promotes antioxidant production and contains nutrients to enable their production; Lono K containing nitrogen and potassium; and Lono Plus containing nitrogen and calcium (all Levity Crop Science, UK). Each fertilizer was applied individually at a range of application rates (Albina and Indra at 0.5, 0.75, 1 and 1.25 l/ha for three applications; Lono K and Lono Plus at 1, 1.5, 2 and 2.5 l/ha for five applications) in addition to the grower's standard edaphic fertilisation program at two different locations in Columbia in 2022. The stem length and diameter; number of stems and flowers; weight of stems; shelf life; and cost benefit were recorded and calculated. All products at all application rates gave significant improvements over the grower standard edaphic fertilisation program. For Albina the 1 and 1.25 l/ha application rates, for Indra the 0.75, 1 and 1.25 l/ha application rates and for Lono K and Lono Plus the 1.5, 2 and 2.5 l/ha application rates were significantly better than the other application rates and were not significantly different from each other within each product that was applied. When considering the return on investment of applying the products, the 1 l/ha Albina, 0.75 l/ha Indra and 1.5 l/ha Lono K and Lono Plus application rates were the best for the growers to use.

Posters ornamentals

Bacteria in vase solution affect water uptake and postharvest qualities of cut lilies, especially early-harvest lilies with small buds

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Abstract

The xylem occlusion by bacteria is a main issue in the postharvest maintenance of cut flowers. Lily is thought to be relatively tolerant to "dirty water" compared to other cut flowers, such as gerbera and roses. Besides, lily growers might harvest lilies at different maturities to meet different markets demands. To clarify the myth, we investigated the effects of bacteria on postharvest quality and water uptake of lilies at different harvest stage. Stems of Lilium 'Nashville' and 'Sorbonne' were harvested at two stages. The "large bud" group were harvested a day before the first flower opened. The first and second buds were colored and puffy. The "small bud" group were harvested a week before the first flower opened and only the first buds was slightly colored. Stems were placed into test tubes containing tap water (1.3 × 10 2 cfu·mL -1) or bacterial water (BW) (6.3 × 10 6 cfu·mL -1). For both maturation stages, BW reduced cumulative water uptake in both cultivars after 1 and 7 days in the vase. The higher water uptake also contributed to greater FW increase, particularly in 'Sorbonne'. Average flower diameter, individual flower life and vase life in 'Sorbonne' were affected by BW in both bud size groups, but harvest stage had little effect on these postharvest parameters. However, noticeably, BW treated 'Sorbonne' showed obvious reduced flower diameter of the 4 th bud compared to the 1 st flower in the small bud, but this effect was not seen in the large bud group. Unlike 'Sorbonne', with 'Nashville', harvest stage had no effect on the ratio of oldest to youngest flowers as a result of BW treatment. To sum up, bacterial water reduced water uptake and postharvest qualities on both varieties, and lilies harvested at younger stage were less tolerant to bacterial levels in the vase.

Posters ornamentals

Initial headspace composition affects the respiration in Chrysanthemum but not in azalea cuttings

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Abstract

Optimization of the storage and transport conditions of propagation material is essential to avoid losses along the production chain and to assure optimal quality of ornamental plants. Equilibrium Modified Atmosphere Packaging (EMAP) aims to achieve a constant headspace composition during storage by balancing the permeability of the packaging material and the respiration rate of the plants at a given temperature. In order to develop such EMAP materials, insight into the storage-related parameters influencing the plant respiration rate, such as headspace oxygen and carbondioxide levels and temperature, is pivotal. In this study, we investigated the influence of the initial O 2 and CO 2 concentrations on the respiration rate of azalea and Chrysanthemum cuttings. For azalea, three headspace compositions (10% O 2 + 90% N 2 , 10% O 2 + 5% CO 2 + 85% N 2 and 10% O 2 + 10% CO 2 + 80% N 2) were used at two different storage temperatures (4 and 10°C). For Chrysanthemum , two cultivars (A and B) were subjected to three headspace conditions (10% O 2 + 90% N 2 , 15% O 2 + 85% N 2 and 10% O 2 + 5% CO 2 + 85% N 2) at two storage temperatures (2°C and 14°C). The respiration rates were calculated for two intervals of oxygen concentration (8% - 2% and 5% - 2%). In the azalea trial, the initial CO 2 concentration did not significantly influence the respiration rate of the cuttings. For Chrysanthemum , higher CO 2 concentrations significantly inhibited the respiration for cultivar B at both storage temperatures, while no effects were found for cultivar A. For both cultivars and both storage temperatures, the respiration rate was significantly lower when the initial oxygen concentration increased from 10 to 15%. Our results indicate that the influence of the initial headspace composition may be cultivar-dependent in Chrysanthemum . Moreover, as a 5% increase in O 2 concentration caused a larger decrease in respiration rate than a 5% increase in CO 2 concentration, other time-related factors are likely to play a role in determining the respiration rate, such as time after harvesting and carbohydrate starvation. Therefore, a constant headspace composition could not be achieved in our trials.