Grower Summary

CP 079

Understanding the underlying mechanisms and the role that pre-harvest horticultural maturity, agronomic factors and growing conditions have on postharvest discolouration in celery

Annual report 2015

Project title:	Understanding the underlying mechanisms and the role that pre-harvest horticultural maturity, agronomic factors and growing conditions have on postharvest discolouration in celery
Project number:	CP 079
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Report:	2nd Annual Report 2015
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Location of project:	Plant Science Laboratory (PSL), Vincent Building (52a), Department of Agrifood, School of Energy, Environment and Agrifood (SEEA), Cranfield University, Cranfield, Bedfordshire, MK43 0AL
Industry Representative:	Emma Garfield (G's Fresh Ltd)
Date project commenced:	16th September 2013
Date project completed (or expected completion date):	16th September 2016

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The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

AUTHENTICATION

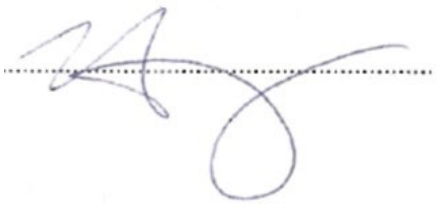
We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

Leon A. Terry

Head of Agrifood

Cranfield University, SEEA

Signature



Date 24/03/2016

Report authorised by:

Emma Garfield

Head of Technical

G's Fresh Ltd (The Shropshire Group)

Signature ..... Date .....

GROWER SUMMARY

Headline

- Celery cut-end browning increased with water stress applied to celery plants.

Background

Celery (*Apium graveolens* L.) is a minor crop which belongs to the *Apiaceae* (or *Umbelliferae*) botanical family. It is commonly eaten for its long and thick petioles which are sold on the market in various retail formats. Celery is appreciated by consumers for its freshness and bright green colour. These two main parameters are visually evaluated on supermarket shelves. One of the main problems affecting celery is postharvest browning, a physiological "disorder" occurring in many fresh vegetables which manifests as black/brown stains occurring on cut surfaces. Although the browning is not thought to be due to microorganism activity, it has a serious impact on consumers who tend to view affected celery as decaying and/or rotten, leading to purchase decreases. This has negative consequences on the profitability of fresh produce production. Postharvest browning is thought to be due to the activity of two enzymes: polyphenol oxidase (PPO) and phenylalanine ammonia-lyase (PALwhich act together to produce the brown pigments which are responsible for the black/brown colour on cut surfaces.

In celery and related crops, there are some studies in the literature which have investigated the incidence of postharvest browning in relation to postharvest factors. Even though this is a starting point, the detailed underlying physiology and biochemistry involved in this "disorder" still remains unknown. In addition, it is still unclear how pre-harvest factors and growing practices may affect celery browning. Thus, further investigation is required to better understand the role of the pre-harvest-postharvest continuum in determining cut-end browning in celery.

Summary

During the 1st year, two experiments were carried out to investigate the role that crop developmental stage and the plant hormone ethylene have on cut-end browning in celery.

Work in year 2 aims were to understand the underlying mechanism involved in the "disorder", particularly paying attention to the effect of deficit irrigation on browning and the changes in the profile/diversity of phenolic compounds.

The experiment, which started on 7th July 2015 and terminated on 20th November 2015, was conducted in a garden polytunnel at Cranfield University, Bedfordshire, UK. All material (transplants and growing substrate) and agronomic advice were provided by G's Fresh Ltd. Three irrigation treatments were applied in total: 800 mL (control), 600 mL (light stress irrigation) and 400 mL (heavy stress irrigation) every alternate day. Water was administered by hand with a graduated plastic container. Soil moisture was maintained at or near field capacity from planting date to commencement of water treatments (5 weeks) to properly develop plants and strengthen roots before applying drought stress. Soil moisture content was periodically measured with a Thetaprobe meter to confirm water treatments and to record soil moisture variation throughout the growing period. Since the different irrigation regimes affected crop growth, plants were harvested at different dates to obtain the same developmental stage. After harvest, samples were transferred to the Plant Science Laboratory for visual and physiological attributes at regular time intervals over storage at 20 °C temperature and 55.5% relative humidity. Samples were assessed immediately after harvest, after 3, 6 and 10 days of storage (baseline, sampling day 1, sampling day 2 and sampling day 3 respectively). After each assessment, samples were cut with a knife, snap-frozen in liquid nitrogen and stored at -80 °C freezers for further analysis.

Extraction and detection of phenolic compounds was carried out on celery dry material of 1st year experiments. High Performance Liquid Chromatography was utilized to detect the key molecules according to plant tissue type and browning severity. Preliminary results showed spatial and temporal changes in the profile of phenolic compounds of celery as affected by various degrees of browning. Considering that the detected phenolic compounds have not been identified yet in literature, more detailed biochemical analyses need to be performed using the appropriate equipment.

Regarding the deficit irrigation trial, soil moisture content results confirmed the different water treatments although periods of hot and cold weather affected the evapotranspiration rate. On the other hand, results from visual assessments and physiological analysis showed that respiration rate and cut edge browning were more pronounced in the less irrigated plants.

Financial Benefits

None at this time.

Action Points

Results arising from this part of the project suggest that irrigating celery slightly under its optimum condition can result in reduced postharvest browning.