AHDB
HORTICULTURE

Grower Summary

CP 150

A genetic approach to improving post-harvest quality (HAPI)

Final Report 2018

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Further information

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AHDB Horticulture is a Division of the Agriculture and Horticulture Development Board.

Project title:	A genetic approach to improving post-harvest quality (HAPI)
Project number:	CP 150
Project leader:	Dr Jim Monaghan preceded by Prof. David Pink
Report:	Final report, December 2018
Previous report:	Annual reports, July 2016 and June 2017
Key staff:	Dr Paul Hunter (HAU) Dr Stella Lignou (UoR) Dr Paul Hand (HAU) Dr Carol Wagstaff (UoR) Dr Guy Barker (UoW)
Location of project:	Harper Adams University, University of Warwick, Reading University and industry partner sites.
Date project commenced:	4th May 2015
Date project completed	3rd May 2018

GROWER SUMMARY

Headline

The pink and brown discolouration seen on cut surfaces in lettuce share some biochemical pathways but behave very differently in response to growing conditions. This has allowed researchers to suggest novel breeding targets to reduce both brown and pink discolouration in processed salads.

Background

In commercial lettuce production increased shelf life and waste reduction are key concerns, especially linked to postharvest discolouration of produce in salad packs. Tesco have recently reported that 68% of their salads are thrown away; the situation is similar for other retailers. Jim Monaghan of Harper Adams University, partnered with the University of Warwick and the University of Reading and with commercial partners Bakkavor Foods Ltd, G's Fresh Ltd, Rijk Zwaan Holding Ltd and AHDB Horticulture to better understand the genetics of pinking and browning in lettuce. The retail value of UK processed salads is £800m, however, there is therefore a need to improve postharvest quality to reduce waste and deliver consistently good quality products to consumers.

Summary

Using lettuce lines showing differences in the amount of pink or brown discolouration the team used genetics and biochemical pathways to better understand the phenomenon. The team produced and processed these different lettuces and assessed the amount of discolouration. Genetic factors for discolouration and DNA markers to be used in breeding programmes were identified and gene expression patterns were analysed. This showed that the symptoms of pinking and browning have different genetic controls. Significant quantitative trait loci (QTL-specific groups of genes) were identified for both pinking and browning phenotypes and the lettuce genetic map has been successfully updated with the inclusion of 358 additional markers. Significant variability in both key gene sequences and metabolic activities associated with the biochemical pathways is thought to be involved. Common and unique pathways involved in the two phenotypes were clarified to provide targets for breeding programmes.

Environment has a key influence on the development of symptoms and browning appears to be more sensitive to season than pinking. Warmer conditions during growth are correlated with an increase in browning of cut leaves post-harvest. The team screened material to identify sources that may be used in new breeding material. They looked at the effects of different age leaves. They also ensured that altering susceptibility to discolouration had no effects on pest and disease resistance and importantly on taste.

Financial Benefits

Lettuce breeders will benefit directly from the research as it will provide underpinning knowledge and molecular breeding tools to facilitate breeding of lettuce varieties with reduced propensity to develop post-harvest discolouration. Rijk Zwaan as a partner in this project will exploit the results directly in their lettuce breeding programme.

For processors and retailers, potential benefits include reduction in costs associated with the use of modified atmosphere packaging (which is currently used to control discolouration and prolong shelf life).

Sue Feuerhelm of Bakkavor expands on the benefits of involvement in the project "*Participation in the HAPI project 'A genetic approach to improving post-harvest quality' has enhanced our understanding of the biochemical pathways and potential genetic regulation of*

lettuce discolouration. The outputs potentially inform the seed company partner in fast tracking new varieties with reduced tendency to discolouration – a subject of commercial significance and which we look forward to including in our raw material supplies.
The outputs of this project have resulted in us considering discolouration and its management rather differently. Any form of discolouration is commercially unacceptable, but the discovery that the regulation of pinking and browning are somewhat different has led us to capture routine observations of this important quality defect to differentiate between the two defects.
The project so far has focused on iceberg and cos morphotypes of lettuce, since in these types, discolouration is of prime commercial importance. However, as we try and automate parts of the supply chain of all salads, primarily harvesting, the impact of discolouration becomes more significant. It affects shelf life and quality of salads, such as baby leaf varieties, and indeed, discolouration can be a limiting factor in our ability to adopt machine harvesting."
Lettuce growers will benefit from the research by the development of varieties with reduced discolouration regardless of the growing environment thereby reducing production costs associated with wastage.
The ultimate beneficiaries of this research will be consumers who rely on appearance to judge produce quality. Reducing and/or delaying onset of discolouration would reduce food waste both within the supply chain and post-purchase.