



Agriculture & Horticulture
DEVELOPMENT BOARD



Grower Summary

FV 395

Strategies for broccoli
management to improve quality
and extend storage life

Final 2013

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HDC is a division of the Agriculture and Horticulture Development Board.

Project Number: FV 395

Project Title: Strategies for broccoli management to improve quality and extend storage life

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Industry Representative: Gavin Willerton

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Further information

If you would like a copy of this report, please email the HDC office (hdc@hdc.ahdb.org.uk), alternatively contact the HDC at the address below.

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GROWER SUMMARY

Headline

- Storage life and shelf-life quality of broccoli cv. Ironman may be improved by:
 - o Removing background ethylene via ethylene scrubbing;
 - o In-field application of azoxystrobin or post-harvest application of 1-MCP, or a combination of azoxystrobin followed by 1-MCP.
- Chlorophyll fluorescence may be more useful than visual assessments or colour meter readings in detecting changes in product quality.

Background

The aim of this project is to define strategies for pre- and post-harvest management of broccoli to improve quality and extend storage life. The outputs of the project will enable the industry to reduce waste and crop losses both in the field and post-harvest. The strategies tested include: technologies to reduce the concentrations of ethylene in pack-houses and store rooms, particularly evaluating the suitability of ethylene scrubbing technology; the use of the ethylene antagonist SmartFresh™ (1-MCP); and the use of pre-harvest chemical treatments to manipulate ethylene production and response by broccoli. In addition, the project is investigating the use of chlorophyll fluorescence to assess maturity and shelf-life of broccoli at harvest and thereby to improve the consistency of the harvested crop.

Summary of project and main conclusions

Background ethylene sampled in store rooms is sufficient to accelerate the rate of broccoli senescence during shelf-life.

Implementation of ethylene scrubbing technology on a commercial broccoli store was shown to reduce background ethylene from 400 ppb to ~200 ppb. The benefit in lower ethylene was to maintain the background green colour of broccoli during storage and shelf-life and to reduce (1–2%) weight loss.

The impact on of pre-harvest sprays of cypermethrin and azoxystrobin over a 3 seasons, used as part of standard crop protection programme on broccoli quality was assessed. Results from trials confirm that azoxystrobin has secondary beneficial effects on improving the retention of green background colour during shelf-life.

A split application of 1-MCP 312 ppb applied at harvest, and a second application after three weeks storage, reduced the onset of senescence during shelf-life (18°C). Moreover, combining the split application of 1-MCP to broccoli treated with azoxystrobin three weeks before harvest was the most effective treatment retarding the onset of senescence in broccoli in one out of the two years this protocol was tested. A split dose of 1-MCP reduced the decline in vitamin C (ascorbic acid) content in broccoli stored over a 21 day period. The effectiveness of treatments in reducing senescence is affected by pre-harvest stresses encountered by broccoli during the growing season.

Chlorophyll fluorescence has been used as a tool to study the process of photosynthesis for many decades. Models of the functioning of the photosynthetic system have been used to relate fluorescence characteristics to specific physiological aspects of chloroplasts. The characteristic that appeared to be most sensitive to broccoli senescence was reaction centres/cross-section (RC/CS), which relates to the concentration of functional photosynthetic reaction centres.

Chlorophyll fluorescence was able to track changes in head quality with storage and there is limited evidence that the technology can identify changes in head maturity at harvest.

Financial Benefits

In-field application of azoxystrobin, minimising the build-up of ethylene in the storage environment, post-harvest treatment using 1-MCP, and a combined treatment of pre-harvest azoxystrobin application followed by post-harvest 1-MCP application have all been shown to improve the storage and shelf-life of broccoli. Management of broccoli in this way can keep product quality higher for longer, thereby reducing the need to import broccoli during low UK production times, as well as reducing waste and crop losses.

Action Points

- Reducing background ethylene in stores can improve storage and shelf-life of broccoli. Use of electric-powered fork-lift trucks in confined storage spaces will lower the the build-up of ethylene.
- Broccoli product quality can be extended by using a split application of 1-MCP at harvest and prior to removal from storage. On crops previously treated with azoxystrobin as a crop protection measure, subsequent application of 1-MCP can have secondary additive effects on improving shelf-life quality.

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