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VG16028: ON-FARM EVALUATION OF VEGETABLE SEED VIABILITY USING NON-DESTRUCTIVE TECHNIQUES

FACILITATORS:

Project VG16028 was completed by Dr Jitka Kochanek from the University of Queensland.

INTRODUCTION

Vegetable crops that are field-established from seed, such as corn, beans, carrots and spinach, require excellent seed quality or growers risk their investments being lost or wasted. Most growers described quality seeds as their most important farm input.

With a focus on fostering collaboration with growers, scientists and seed producers, this multi-faceted project aimed to identify on-farm issues relating to seed quality to optimise seed longevity and seedling establishment success. Another key focus of the project was to review non-destructive and cost-effective techniques to screen viable seed and maximise generation and vigour once planted.

ABOUT THE PROJECT

Dr Jitka Kochanek is the University of Queensland's Research Leader of the Plant Growth and Productivity Optimisation Laboratory.

As part of project VG16028 – *On-farm evaluation of vegetable seed viability using non-destructive techniques*, Dr Kochanek surveyed 10 leading growers and two industry affiliates in the Lockyer Valley and Fassifern Valley (Queensland) and Sydney Basin and Bathurst (New South Wales) who had determined that seed viability, purity and quality issues were a major concern in the vegetable industry.

A global review of literature and future programs was also conducted to gain input from research allies with capacity to develop the most promising technologies to overcome seed quality issues. For example, robotic systems developed at the Australian Centre for Field Robotics at the University of Sydney could be redesigned into new artificial intelligence technologies to non-destructively grade seeds.

The review included analysing emerging non-destructive and cost-effective technologies to screen viable seed and maximise germination and vigour. Areas of interest included destructive tests used in accredited laboratories and new tests emerging in research facilities; machinery to process seeds for improved quality; and non-destructive technologies that use computer-assisted analysis for real-time automation of seed quality grading.

A vegetable seed longevity review component was added to enhance knowledge about Australian crops together with insights into how on-farm storage conditions, such as high relative humidity and high temperatures, can result in rapid seed quality decline.

The results of continuing surveys and reviews were communicated via an information-sharing field day in the Sydney Basin in March 2017, and the compilation of four bulletins recognising industry needs and recommendations; technology and future project recommendations; optimised seed storage conditions; and grower issues and R&D needs.

MAJOR FINDINGS

Certain seed suppliers consistently did the right thing by growers. However, contrary to expectations, all surveyed growers reported seed viability, purity and/or quality issues from other suppliers. In fact, some growers had resorted to importing seed because Australian seed suppliers did not meet quality and quantity standards for certain varieties.

Grower recommendations included developing Australian standards for seed quality (including penalties for non-adherence) and improving labelling on seed packaging, developing technologies to non-destructively grade seeds and R&D programs to better understand and maximise vegetable seed viability and longevity during seed development, harvest, storage and on-farm. A longer-term prospect included developing new varieties for local conditions via, for example, a Centre for Vegetable Excellence and/or undertaking screening trials with seed companies.

In terms of technology, research has identified hyperspectral imaging as the best computer-assisted analyses to grade seed quality attributes. It combines the spectral information of spectroscopy with spatial distribution data from computer vision to create a 3D image 'hypercube' that classifies seeds based on their external and internal quality characteristics.

CONCLUSION

Dr Kochanek said the development of an Australian standard that uses best practice would improve consistency among seed suppliers.

A grower-driven R&D strategy meeting is scheduled for autumn 2018 to outline long-term research programs, and prioritise what growers want, what they want to achieve and what budget is required.

Due to each of the seed quality challenges requiring unique solutions, R&D activities have been divided into six pillars: germination, viability, ageing, emergence and vigour; seed borne disease; varietal impurity; damage to seeds; seed mass, fill and density; and seed size, uniformity and shape.

For example, one area for future research includes a definitive classification of key Australian crops as short- to long-lived to improve seed storage practices.

Potential also remains to work with specialist bodies to develop robotics, intelligent systems and sensor technologies to maximise seed viability before planting.

ACKNOWLEDGEMENTS

This project is a strategic levy investment under the Hort Innovation Vegetable Fund.

VG16028 was funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government.

VG13083: IDENTIFYING AND SHARING POSTHARVEST BEST PRACTICE ON-FARM AND ONLINE

FACILITATORS:

Project VG13083 was completed by Dr Jenny Ekman from Applied Horticultural Research.

INTRODUCTION

The vegetable industry has invested significantly in research to increase productivity and efficiency, but the link between the farm and the consumer – postharvest management – has had relatively little research for the past three decades.

Although there are many references to optimum storage temperature and expected shelf life of vegetables, most are based on *The Commercial Storage of Fruits, Vegetables and Florist and Nursery Stocks, USDA Agricultural Handbook '66*. First published in 1954, its recommendations have changed little in 50 years. For example, it recommends 0°C storage for 23 of 34 vegetable lines. However, such low temperatures increase energy and equipment costs and risk freezing product – often for minimal additional storage life.

ABOUT THE PROJECT

Led by Applied Horticultural Research scientist Dr Jenny Ekman, project VG13083 *Identifying and sharing postharvest best practice on-farm and online* examined the effect of temperature (2°C, 4°C, 7°C and 12°C) on storage life for a range of vegetables. These included buk choy, choy sum, gai lan, bitter melon, baby spinach, rocket, kale, spring onion, red capsicum, green capsicum, cucumber (field and greenhouse), eggplant (field and greenhouse), green beans, baby squash and zucchini.

The researchers also modelled rates of water loss by temperature and humidity, identifying how much water the produce can lose before becoming unacceptable.

However the main purpose of the project was to produce resources that growers could use, and communicate issues around postharvest best practice in the vegetable supply chain.

MAJOR FINDINGS

While most vegetable growers are doing a good job cooling and packing product postharvest, the project found many areas for improvement. Some practices were relatively inefficient, and there is a clear need for more information and training within the supply chain.

One example is the practice of packing broccoli in polystyrene containers with flaked ice. Simply keeping the broccoli consistently cold in a lined carton will maintain freshness, as is already done for many other perishable vegetables.

Similarly, new varieties of red capsicums are less sensitive to cold than suggested by existing storage recommendations. Although retailers require delivery temperatures of 7-12°C, the best storage temperature for red capsicums is close to 2°C.

Temperature is the most important factor affecting quality and shelf life, so managing temperature is key to retailer and consumer satisfaction. Simple single use temperature loggers, or even automated GPS loggers, can track the crop in transit, identifying which parts of the supply chain are working well, and which are not.

Having gathered new information, a three-pronged approach was used to convey the findings to vegetable growers – an innovative handbook, website and workshops.

The 150-page book, *Postharvest management of vegetables – Australian supply chain handbook*, outlines the best and most cost-effective ways of handling vegetables. It is divided into three sections relating to postharvest principles, crop-specific information (for 22 vegetables) and reference tables and charts.

A website, postharvest.net.au, was also created to complement and expand upon the book. It provides links to further reading and fact sheets.

A series of 12 half-day professional development workshops were also conducted to help packing shed managers, quality assurance officers and supply chain business representatives optimise their handling and storage of vegetables, maximising quality and minimising losses.

CONCLUSION

In the last few years relatively little research has been conducted on what happens within vegetable supply chains or under commercial conditions. However, it seems likely that many widely-used postharvest recommendations for vegetables are either inefficient, inaccurate or do not exist. But Dr Ekman says handling practices are crucial.

"What matters is not how long the vegetable has been stored, it's how well it has been stored," she said.

The project generated new data and communicated postharvest best practice through the handbook, website and industry workshops. However, it is evident that more research is required to validate specific findings.

The importance of postharvest management has been demonstrated on myriad levels and often with practical, cost-effective solutions. For example, the water-loss model can be used to estimate the amount of product that needs to be over-packed (e.g. five per cent) to ensure packages remain above the label weight after storage and transport.

Scope remains for further research, expansion of a retailer-training program and development of a two-day postharvest masterclass for experienced practitioners. Potential also exists to create training modules with retailers to increase staff knowledge of storing and displaying vegetables to avoid wastage and product damage.

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THE BOTTOM LINE: ON-FARM EVALUATION OF VEGETABLE SEED VIABILITY USING NON-DESTRUCTIVE TECHNIQUES (VG16028)

Project VG16028 aimed to provide growers with options and recommendations to overcome poor seed quality and increase viability.

On-site grower interviews and surveys were conducted with 10 leading growers and industry affiliates in Queensland and New South Wales, as well as a comprehensive literature review that examined the real-time technologies and conditions required to maximise seed vitality and longevity. Work was also conducted to determine hyperspectral imaging as the best computer-assisted analyses to grade seed quality attributes.

A series of grower-led recommendations provide scope for research in multiple areas, including developing Australian standards for seed quality, improving labelling on seed packaging, developing technologies to non-destructively grade seeds and R&D programs to better understand vegetable seed viability and longevity. These recommendations will be further discussed in coming months.

Potential also remains to work with specialist bodies to develop robotics, intelligent systems and sensor technologies to maximise seed viability before planting.

FURTHER INFORMATION

For more information about the research, please contact Dr Jitka Kochanek at j.kochanek@uq.edu.au.

The final report for this project will be made available on InfoVeg. Readers can search 'VG16028' on the InfoVeg database: ausveg.com.au/infoveg/infoveg-database.

THE BOTTOM LINE: IDENTIFYING AND SHARING POSTHARVEST BEST PRACTICE ON-FARM AND ONLINE (VG13083)

Project VG13083 examined the effect of temperature on the storage life of a range of vegetables sourced from growers or Sydney Market within a day of harvest. It also modelled rates of water loss according to temperature and humidity, identifying how much water the produce can lose before becoming unacceptable.

The results were applied to raise awareness of cooling issues, clarify delivery temperatures to retailers for various vegetables, and highlight the influence of water pH on sanitisers.

The main purpose of the project was to produce resources that growers could use, and communicate issues around postharvest best practice in the vegetable supply chain. Project leader Dr Jenny Ekman presented her findings to growers in three ways: a 150-page handbook; the postharvest.net.au website that outlines principles, best practice recommendations and provides reading links and fact sheets; and workshops to educate growers and retailers about the benefits of upgrading their postharvest practices.

Scope remains to conduct research on postharvest best practice in Australia and globally, with Dr Ekman heartened by the positive response from growers and retailers.

FURTHER INFORMATION

For more information about the report, please contact Dr Jenny Ekman at jenny.ekman@ahr.com.au or 02 8627 1040.

The final report for this project is available on InfoVeg. Readers can search 'VG13083' on the InfoVeg database: ausveg.com.au/infoveg/infoveg-database.

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Please contact Michelle De'Lisle at AUSVEG via email at michelle.delisle@ausveg.com.au or call 03 9882 0277 to submit topics for potential inclusion in future editions of *Vegenotes*.