Understanding tuber formation to reduce greening

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Introduction

The below-ground development of the potato crop is poorly understood. Differences in stolon length and depth have previously been identified between varieties (Firman 1995, 1996) but it is uncertain how consistent these differences are and the extent to which the environment can affect them. In-field greening can cause over 20 % of yield to be rejected in the pre-pack sector (Coleman 2010) but the physiological and agronomic factors that lead to such high wastage are uncertain. In this work, the stolon architecture and tuber positions of seven varieties were characterised over the course of a season. Improving our understanding of how tubers form will assist in growing crops with fewer green tubers.

Objectives

- Quantify the length of stolons, the depth at which they attach to the stem, and how this differs between varieties.
- Determine how differences in stolon architecture may affect the susceptibility of varieties to in-field greening.

Methods

Seven varieties (Estima, Jelly, King Edward, Marfona, Maris Piper, Markies and Melody) were grown in a randomised block design. Four plants were excavated *c.* 40, 70 and 100 days after emergence (DAE) and the position of each tuber was measured, along with the depth and length of each stolon (Figure 1). Twelve plants were harvested *c.* 120 DAE and assessed for the incidence and severity of tuber greening. Commercial crops were surveyed using similar methods to establish whether environmental factors influence stolon length and depth.

Figure 1. Marfona plant excavated to allow tuber positons to be measured.

Results

Average stolon length was shortest in King Edward and longest in Jelly (Figure 2) but there were no differences in stolon depth (data not shown). Stolon length is one component of the cluster width (Figure 3) and varieties with wider clusters are expected to be more susceptible to greening, but differences in stolon length or tuber size with depth may also have an influence. Data on tuber position and tuber greening is awaiting analysis but will reveal where green tubers were within the ridge and how stolon architecture affected tuber position. In Jelly, stolon length was found to vary considerably between sites indicating that stolon length is not consistent within a variety (Figure 4).

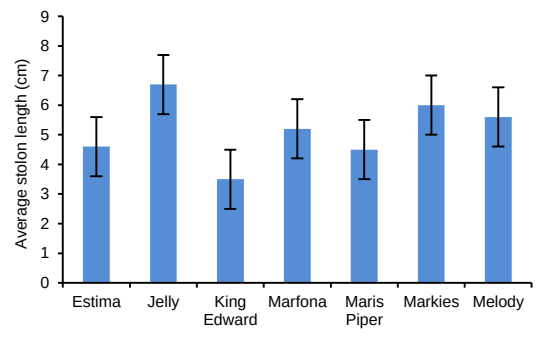

Figure 2. Average stolon length of seven varieties 44 days after emergence. Bars represent S.E. based on 18 D.F.

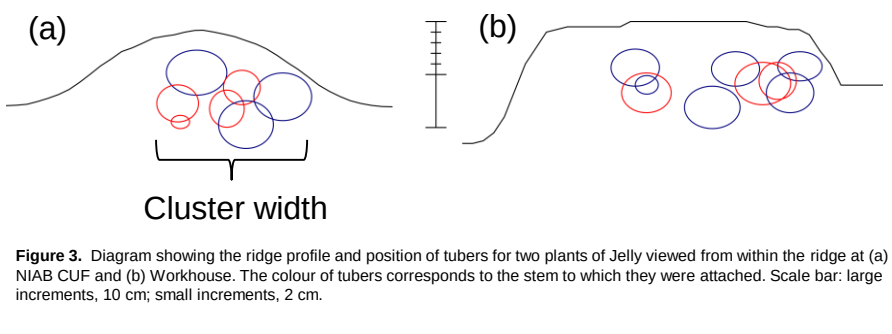

Figure 3. Diagram showing the ridge profile and position of tubers for two plants of Jelly viewed from within the ridge at (a) NIAB CUF and (b) Workhouse. The colour of tubers corresponds to the stem to which they were attached. Scale bar: large increments, 10 cm; small increments, 2 cm.

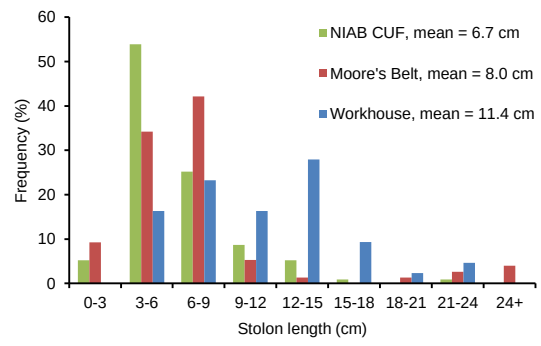

Figure 4. Frequency distribution of stolon length in Jelly at three sites.

Implications for the Industry

With data from only one year implications of the findings remain to be established. Further experiments are required to establish whether varieties differ consistently and whether any differences correlate with susceptibility to greening. Characterising the cluster width of varieties may assist growers in choosing the optimum ridge shape for specific varieties. If varieties are found to have consistent differences in stolon architecture, this may assist breeders in identifying genes responsible for affecting stolon architecture and aid development of varieties with reduced susceptibility to greening.

Acknowledgements
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References
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