Grower Summary

FV 439

To identify pre-harvest, harvest and post-harvest management practices capable of reducing losses of pumpkins during storage

Final 2017

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Project title:	To identify pre-harvest, harvest and post-harvest management practices capable of reducing losses of pumpkins during storage
Project number:	FV 439
Project leader:	Debbie Rees, Produce Quality Centre, Natural Resources Institute (NRI), University of Greenwich.
Report:	Final report, February 2017
Previous reports:	Annual report, April 2015; Annual report, April 2016
Key staff:	Debbie Rees (NRI, University of Greenwich); Richard Colgan (NRI, University of Greenwich); Marcin Glowacz (NRI, University of Greenwich); Peter Waldock (Growing Earth Consultancy Ltd); Gerard Bishop (NIAB East Malling Research); Robert Saville (NIAB East Malling Research); Jennifer Kingsnorth (NIAB East Malling Research)
Location of project:	Natural Resources Institute, Jim Mount Postharvest facility, East Malling Grower sites: Oakley farms (Cambridgeshire), Dan Mackeldens (Kent)
Industry Representative:	David Murfitt, Oakley Farms (2014, 2015)
Date project commenced:	15 September 2014
Date project completed	28 February 2017

GROWER SUMMARY

Headlines

- A programme of field treatments, including fungicidal treatments focused on control of *Phoma* and powdery mildew, combined with mineral nutrition, can provide substantial benefits by increasing yield of marketable pumpkins with some additional benefits due to reduction in postharvest rots.
- The identification of *Phoma* and *Fusarium* within the crop has also led to the application for and granting of 2 EAMU's (Signum and Switch) giving growers chemical controls that were not available before the project.
- As a result of this work, the Outdoor Cucurbits Crops Walkers' Guide is being updated to include pumpkin storage issues.

Background

The market for carving pumpkins in the UK, currently estimated at £14-15M per year is growing at a rate of 20% annually. The exact levels of loss during storage are unclear, but at the start of this project were estimated to be 15-20% equating to an annual loss of £2-3M for decorative pumpkins alone.

Despite these high losses, at the start of this project there was little reliable information either on the main forms of loss for UK pumpkins (physiological, latent infection, post-harvest infection) or on the key factors (mineral nutrition, harvesting/post-harvest practices, storage environment/practices) affecting losses.

The overall aim of this project was to identify pre-harvest and post-harvest management practices capable of reducing losses of both edible and carving pumpkins, thereby providing a significant increase in profitability for the UK pumpkin industry. The approaches taken to achieve this were; to carry out storage trials in order to identify the main causes of loss, to test out field management practices that could increase yield and reduce losses, and to characterise the fruit from a range of pumpkin varieties, relating these to storability in order to identify those characteristics associated with good storability. Although an initial objective was to test out adaptations of storage strategies the economics of the pumpkin market do not allow farmers to invest in storage structures, so that this objective was not investigated, beyond assessing growers' stored bins to understand breakdown issues in diferent storage environments in 2014. More emphasis was placed on preharvest management.

Summary

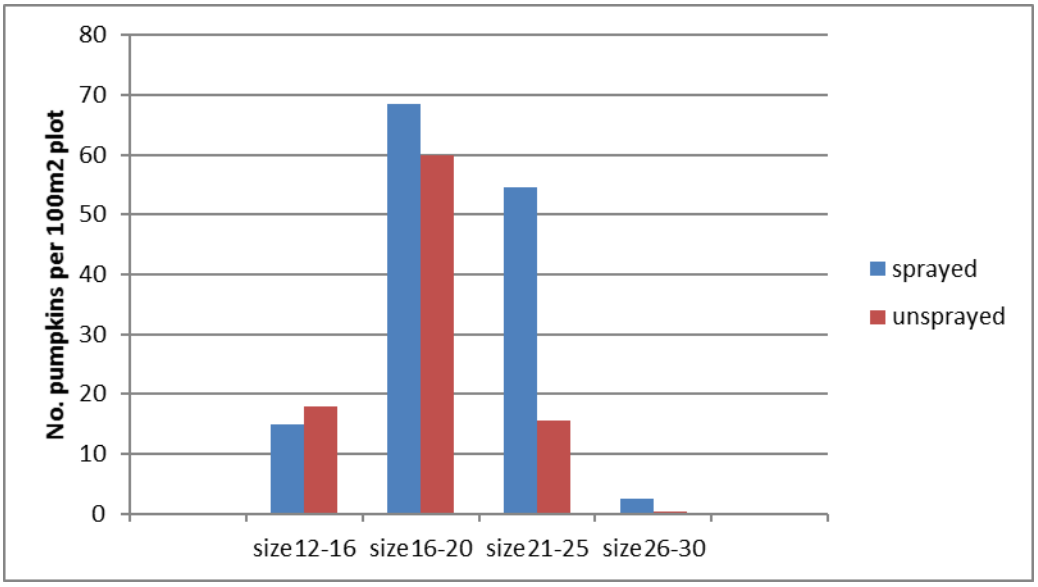
Given that the market for pumpkins is currently much stronger in the USA than in the UK, information on practices in the US was collated both from the literature and by direct communication with US growers and seed companies. It is notable that a strong emphasis is placed on chemical control of mildew in the US; the perception being that mildew damage of the stem increases the entry of rotting pathogens by that route into the pumpkin. A trial conducted in Cambridgeshire in 2015 indicated that powdery mildew control could increase yield in some varieties (Mars), but no effect on losses due to postharvest rots was observed.

However, a survey of rots in 2014 and 2015 identified the main cause of postharvest loss to be *Phoma cucurbitacearum.*

Figure A. Rotting of stored pumpkins due to *Phoma cucurbitacearum*

Contrary to the effects of spraying against powdery mildew alone, a spray programme tested in 2016, that combined treatment against *Phoma* and powdery mildew with mineral nutrition had positive effects on yield in trials in two very different locations. The yield of pumpkins classified into size categories from trials conducted in Cambridgeshire and Kent are shown in Figure B.

A.



B.

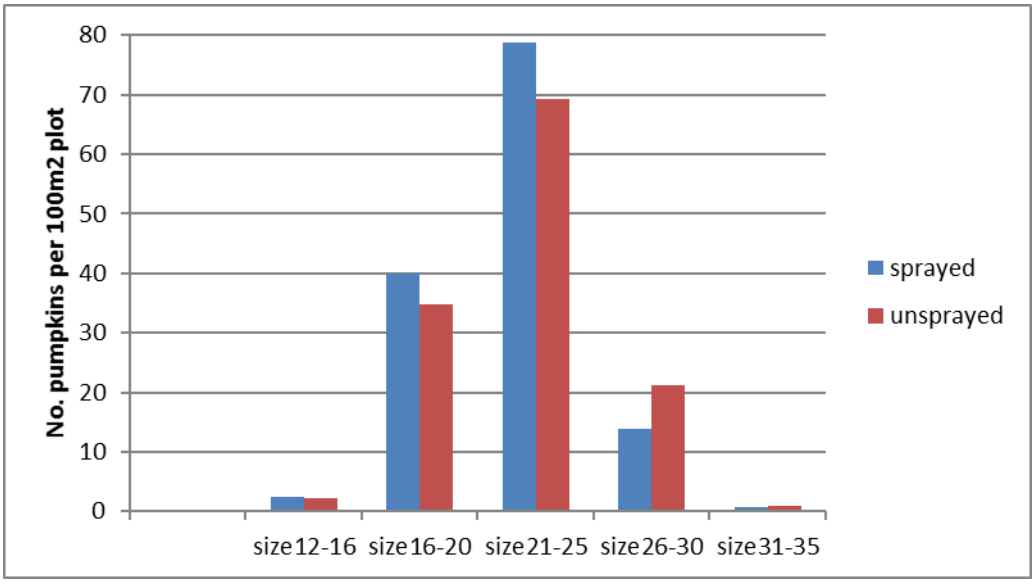


Figure B. Yield and size of pumpkins grown with and without a programme of fungicidal spray and mineral nutrition at two sites; A. Cambridgeshire, and B. Kent. Each data point is the mean of data from 6 or 4 100 m^2 plots.

At both sites the number and size of pumpkins were increased; with a very marked effect in Cambridgeshire. A simple cost benefit analysis for each site, assuming a cost of 80p per pumpkin indicated that the spray costs were more than compensated for in each case; thus in Kent a spend of £232 per Ha, gave a gain of £560, while in Cambridgeshire a spend of £341 per Ha gave a very substantial gain of £3760.

Harvested pumpkins were stored in bins under cover for 12 weeks, after which time there was a statistically significant difference in rates of rotting, with less rotting for the treated plots, the main impact being on incidence of *Phoma*. Although this period of storage is longer than UK

pumpkin growers usually store, the results give an indication of probably impact for years of high storage losses.

The strategy of testing out the fungicidal treatment against *Phoma* in combination with mineral nutrition allowed us to maximise our chances of identifying a beneficial treatment within existing resources (specifically time inputs). If further work can be carried out with the support of growers in the coming seasons, it would be possible to refine field strategies, separating the effects of fungicide and mineral nutrition, in order to maximise the benefit to cost.

Characterisation of pumpkin varieties was carried out over three seasons; 2014, 2015 and 2016, with support from seed companies. As the market develops and seed companies try out different varieties, it was not possible to test the same varieties, nor use the same planting sites consistently over the three seasons. Nevertheless the information obtained during this project is to our knowledge the first time that UK pumpkin varieties have been characterised in this way and it has allowed the initiation of a database to provide indicators for the development of good storing varieties. Pumpkin fruit were characterised in terms of flesh firmness, skin strength, colour, thickness of flesh, dry matter content and composition (sugar profile) and mineral content. All of these characteristics were compared with observations of keeping qualities. There were some indications that calcium content related to good storability, but the characteristic that was most consistent within size ranges was dry matter content; high dry matter content related to improved storability. This observation also held when comparing the behaviour of varieties under different growing conditions. Pumpkin growers choose varieties depending on growing location; thus Racer is considered a good variety in Hampshire compared to Mars and Harvest Moon, but is considered bad in Cambridgeshire. This distinction is also seen in the comparison of dry matter content; Racer had the highest dry matter content of these three varieties in Hampshire, but the lowest in Cambridgeshire.

Financial Benefits

At two sites tested, a spray programme for control of *Phoma* and powdery mildew, combined with mineral nutrition, led to an increase in the number and size of pumpkins at harvest; with a very marked effect in Cambridgeshire. The programme relied on the use of Signum and Nimrod (both of which have approval for the use on field pumpkins). Mineral nutrition focused on calcium, boron, manganese, copper and magnesium sulphate. A simple cost benefit analysis for each site, assuming a cost of 80p per pumpkin indicated that the spray costs were more than compensated for in each case; thus in Kent a spend of £232 per Ha, gave a gain of £560, while in Cambridgeshire a spend of £341 per Ha gave a very substantial gain of £3760.

Action Points

The output from this project with most immediate significance for the industry is that there is potentially a very significant financial benefit from field treatment of pumpkins for fungal control and mineral nutrition. However in order to refine recommendations for field applications there is a need for a coordinated approach among growers to test strategies against unsprayed controls for a range of varieties in a range of locations.

Likewise a coordinated approach among seed companies to understand postharvest behaviour of new varieties would be of enormous potential to growers.