Crop management strategies to improve pumpkin storage

Figure 1. Rotting of stored pumpkins due to *Phoma cucurbitacearum*

The market for both decorative and culinary pumpkins is increasing in the UK, but there has been little previous work to optimise field management and handling practices. This factsheet presents the findings of AHDB Horticulture project FV 439 *'Cucurbits: Identifying pre-harvest, harvest and post-harvest management practices capable of reducing losses of pumpkins during storage'*, which first identified the main causes of post-harvest losses in pumpkins and then tested field management strategies to reduce these losses and increase profit margins for growers.

Action points

- ***Phoma cucurbitacearum* is the major cause of post-harvest storage losses in UK pumpkins. Mineral nutrition focusing on calcium, boron, manganese, copper and magnesium sulphate, in combination with disease control programmes that use Signum and Nimrod during crop growth reduce storage losses**
- **Assuming a cost of £0.80 per pumpkin, the experimental nutrition and fungal spray programmes employed in project FV 439 led to variable but significant financial benefits, which amounted to £298 per ha for the Kent trial site and £3, 419 per ha for the Cambridge trial site**

Background

The market for carving pumpkins in the UK is greater than £15m per year and is estimated to be growing at a rate of 20% annually. The exact levels of pumpkin loss during storage are unclear but, in 2014, they were estimated to be 15–20%, equating to an annual loss of £2–3m for decorative pumpkins alone.

Despite the high losses, there had been little reliable information on either 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.

A stronger market exists for pumpkins in the USA, therefore horizon scanning through literature searches and direct liaison with American partners provided useful fundamental baseline knowledge on US field management strategies to improve pumpkin storage at the start of project FV 439. One observation was that growers in the US place a strong emphasis on the chemical control of powdery mildew, the perception being that mildew damage of the stem increases the entry of 'fruit collapse', causing pathogens into the pumpkin.

Causes of storage losses in UK pumpkins

Surveys of carving pumpkins for storage pathogens were carried out in the UK in 2014 and 2015. In 2014, samples of rotting pumpkins were collected from the field in Cambridgeshire, Kent and Hampshire and from an initial storage trial undertaken in Kent. The most prevalent rotting pathogen was identified as *Phoma cucurbitacearum* (Figure 1).

More quantitative surveys were conducted in 2015. Figure 2 summarises the pathogens causing rots during storage of three varieties of pumpkins (Mars, Harvest Moon and Racer), which were grown and stored in Cambridgeshire and Hampshire. No difference in incidence of rots by the different pathogens was observed between the two locations. *Phoma* was identified as the major cause of storage rots in both locations, despite having markedly different crop rotations in the two geographical regions.

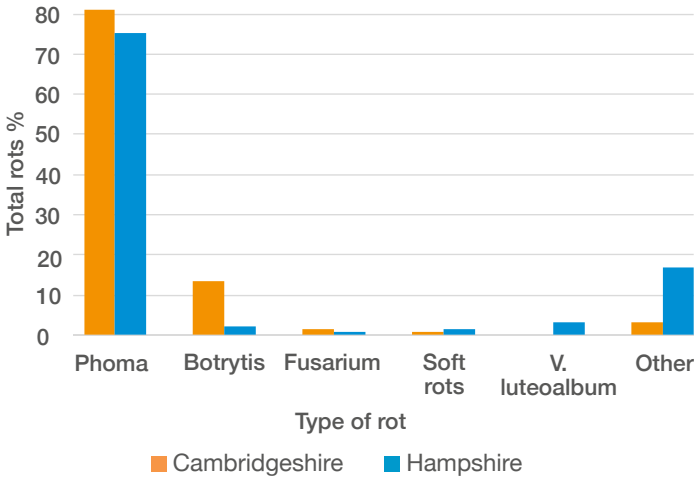

Figure 2. Incidence of rot species observed across three varieties of pumpkin in 2015. Comparison between Cambridgeshire and Hampshire

Figure 3. Pumpkins ready for harvest

Grower strategies to reduce pumpkin storage losses

Given the identification of *Phoma* as a major rotting pathogen for UK pumpkins, and the importance of powdery mildew control for US pumpkin production, spray programmes against both *Phoma* and powdery mildew were tested for disease control efficacy. The fungal control programmes were combined with the application of mineral nutrition during crop growth. The economics of tested strategies were analysed for two grower sites in 2016.

Fungal control programmes relied on the use of Signum (Boscalid/pyraclostrobin) and Nimrod (Bupirimate). Signum was known to be effective against powdery mildew, as well as *Cladosporium* species; it was expected to have efficacy against Phoma. Nimrod has activity against powdery mildew. Mineral nutrition focused on calcium, boron, manganese, copper and magnesium sulphate. The field treatments that were trialled are given in Table 1. The yield of pumpkins (Figure 3), classified into size categories from the trials is shown in Figures 4a and 4b.

Table 1. Applications of fungicide and nutrition used in field trial in Cambridgeshire and Kent in 2016

Site	Date	Fungicide	Nutrition
Cambridgeshire	27/07/2016	Signum (1.5 L/ha)	Calcium 1 L/ha, boron 1 L/ha
	08/08/2016	Nimrod (600 ml/ha)	Calcium 1 L/ha, copper oxychloride 2 L/ha, manganese (as per label)
	18/08/2016	Signum (1.5 L/ha)	Calcium 1 L/ha, manganese (as per label)
Kent	18/07/2016	Signum (1.5 L/ha)	Calcium 1 L/ha, boron 1 L/ha
	05/08/2016	Nimrod (600 ml/ha	Calcium 1 L/ha, full trace elements foliar feed
	20/08/2016	Pot Bicarb (5 L/ha) + silica wetting	Calcium 1 L/ha, manganese (as per label), Bittersalz (magnesium sulphate) as per label

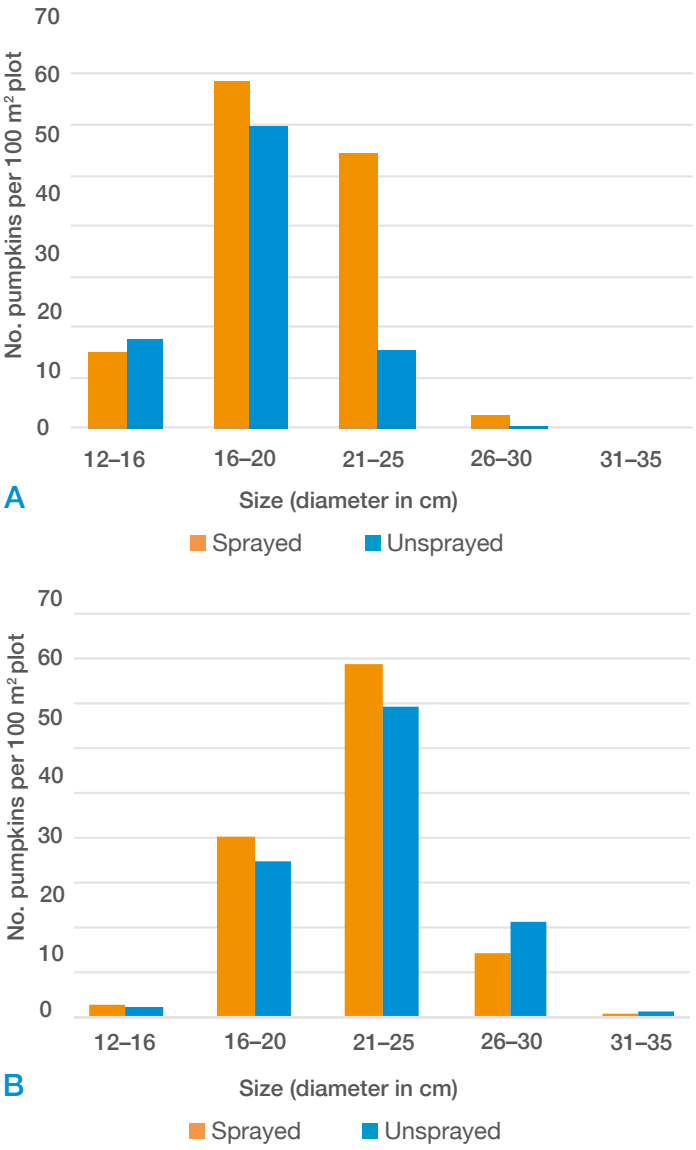

Figure 4. Yield and size of pumpkins grown with and without a programme of fungicidal spray and mineral nutrition at two sites: A. Cambridgeshire; B. Kent. Each data point is the mean of data from six or four 100 m² plots.

At both sites, the number and size of pumpkins increased, with a very marked effect in Cambridgeshire. A simple cost benefit analysis for each site, assuming a cost of £0.80 per pumpkin, indicated that the spray costs were more than compensated for in each case; a spend of £232 per ha in Kent gave a gain of £560, while, in Cambridgeshire, a spend of £341 per ha gave a substantial gain of £3,760.

Harvested pumpkins were stored in bins under cover for 12 weeks before assessment of rots. There was a statistically significant difference in rates of rotting, with less rotting for the treated plots, the main impact being on the incidence of *Phoma*. Although this period of storage is longer than grower practice, these results indicate the probable impact of pre-harvest fungal and nutritional programmes in years of high storage losses.

Conclusion

Although trials in project FV 439 did not point out a single active ingredient or nutritional element with the most impact in reducing post-harvest storage losses, the project demonstrated that there is significant benefit in employing fungal and nutritional spray programmes during crop growth to reduce pumpkin storage losses. Growers who are interested in refining nutrition and fungal spray programmes for their own specific sites are therefore encouraged to join up with other growers, wherever possible, and embark on coordinated grower trials, testing different strategies for a range of pumpkin varieties across different geographical locations and soils, using unsprayed plots as controls. Only Plant Protection Products approved for use on pumpkin should be included in such trials.

The benefits of the crop management programmes presented here are encouraging, but note should be taken that results are based on a single season of data from two grower sites. Further information from growers testing different fungal control and nutrition application strategies will optimise field management strategies, to further reduce losses and increase profits.

This project identified pathogens not previously recognised as causing fruit storage issues in UK pumpkins. As a result of the project, the successful application for two EAMUs for the use of Signum and Switch were gained. These products now provide growers with chemical controls that were not available before the project.

Acknowledgements

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