FACTSHEET

Managing the risk of black dot

Introduction

Black dot is one of the most important blemish diseases of the potato packing industry and can cause a significant decrease in produce quality through downgrading and consequent economic loss[1].

Symptoms of black dot can be similar to silver scurf *(Helminthosporium solani)* so it is possible that its presence has been underestimated in the past. The increased significance of black dot has probably resulted from increased levels of soil contamination due to tighter rotations and more effective control of silver scurf.

Integrated control is the best approach to manage the disease. This publication draws from the latest research available on black dot, highlighting some of the factors contributing to disease, to guide best practice.

Black dot overview

The Pathogen

Black dot is caused by the fungal pathogen *Colletotrichum coccodes*, which has a wide host range[2,3] including other Solanaceous species, other crops including onion and beans, and common weeds, such as common nettle and field bindweed. Many infected plant species are asymptomatic or display inconspicuous symptoms.

C. coccodes spores (conidia) can infect and colonise all parts of the potato crop, although in the UK it is the below ground parts of the crop that are typically infected. During the potato growing season, survival structures (sclerotia) form on stems and stolons (Figure 1a). As the crop starts to senesce, sclerotia also form on tubers and these are the typical symptom of black dot (Figure 2a).

Soilborne sclerotia are the most important source of inoculum for black dot. These infection structures can overwinter in the soil, on crop debris, infected tuber volunteers and in other plant hosts. There is evidence that sclerotia can survive for up to eight years in the soil and, when conditions are favourable, produce infective conidia. DNA-based diagnostic methods have been developed to quantify the inoculum in the soil and help inform disease management practices[4,5].

On uncontaminated land, infected seed is the primary means of introducing *C. coccodes*. This can lead to black dot on progeny tubers, but generally not to a level caused by soil inoculum.

Identifying black dot

The characteristic symptoms of black dot are sclerotia that appear as 0.1–0.5 mm black dots, best viewed using a x10 hand lens (Figure 2a). At harvest, areas of affected tuber skin may appear unblemished to light brown but, during storage, irregularly shaped lesions develop and gradually turn darker (Figure 1b).

Figure 1. Black dot symptoms on potato: (a) sclerotia on stolon, (b) dark lesions on tuber skin

Black dot is commonly confused with silver scurf because lesions can look similar. However, they are easily distinguished under a hand lens or a microscope, as silver scurf lesions are characterised by short black threads or bristles called conidiophores on which the spores develop (Figure 2b). Unlike black dot sclerotia, silver scurf conidiophores are easily dislodged during sample washing.

Black dot may also be confused with symptoms of the rarer tuber disease violet root rot (*Helicobasidium purpureum*). This pathogen also produces sclerotia but they appear purple-brown, not jet-black. This disease is usually only a problem where potatoes follow beet or carrots in rotation.

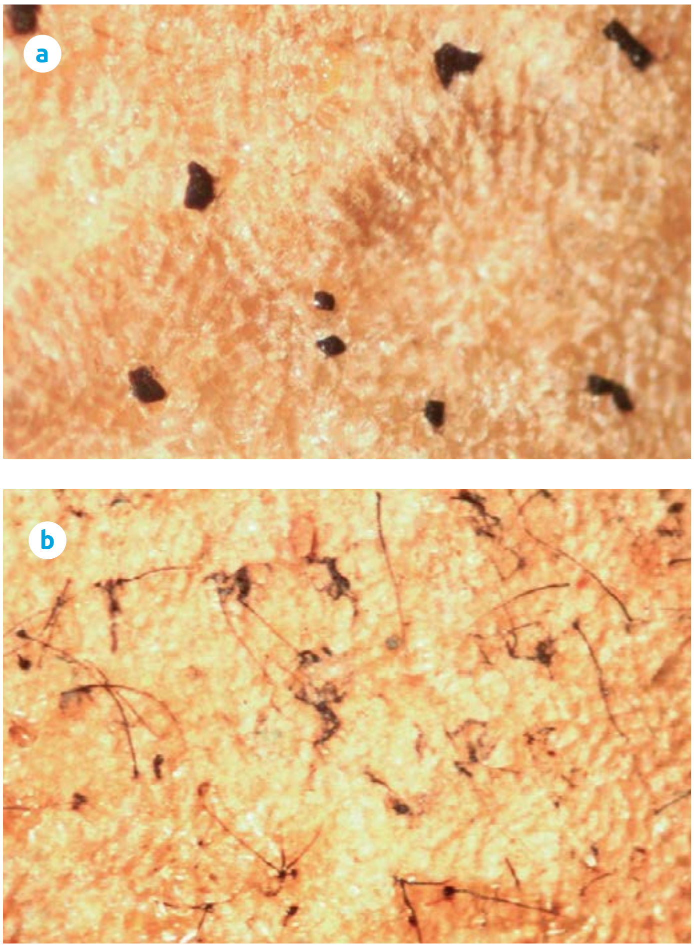

Figure 2. Magnified images of (a) black dot sclerotia on a tuber and (b) silver scurf infection (x40 magnification)

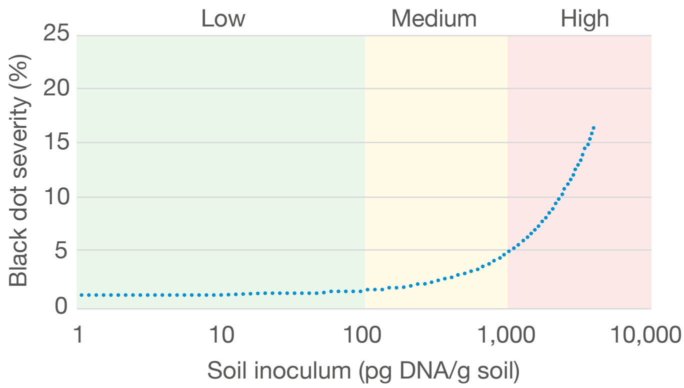

Figure 3. Relationship between black dot soil inoculum and disease severity at harvest. Disease severity increases as soil inoculum increases. Coloured boxes represent relative disease risk rating. This image was created by AHDB, based upon original work carried out by Lees et al (2010)

Risk factors and control measures for integrated disease management

Risk factors are outlined in the table below, with recommended actions in bold. An integrated approach to black dot management includes appropriate cultivation practices[6], control of sources of inoculum (weedy hosts and potato volunteers), accurate disease assessment of seed and soil, together with appropriate post-harvest storage[7].

Table 1. Factors which affect black dot development

Factors	Action	Further information
Variety	Potato varieties vary in their susceptibility to black dot. **Where possible, select a variety that is relatively resistant to black dot.** This is particularly important if there is evidence of the disease in the selected field.	The susceptibility of some varieties to black dot can be found in online databases and publications, including: • *AHDB Potatoes Variety Database* • *NIAB TAG Potato Variety Guide*
Seed health	Avoid contaminated seed, particularly of varieties that are more susceptible and for planting in fields not contaminated with black dot. **On receipt, inspect your seed stock for disease using a hand lens.**	See 'Identifying black dot' section of this publication.
Field selection	Consider field history to decide which land is best suited for the growing season, e.g. avoid short rotation fields with a history of black dot. If short rotations are the only choice, consider additional control factors. A soil test is available to quantify risk of disease. **Keep weeds, volunteers and crop debris under control.**	DNA-based diagnostics have been developed for the detection of *C. coccodes* in soil. Risk is quantified as low, medium and high, and relates to the level of infection predicted at harvest[8] (Figure 3). Uncontrolled host weed populations, overwintering crop debris and high volunteer numbers can significantly increase the risk of black dot development. Weed hosts will increase the long-term persistence of the pathogen in soil.
Crop duration	**Harvest early** where possible, limit duration in the ground according to susceptibility and maturity group of variety grown.	The longer a crop is in the ground, the greater the severity of black dot (Figure 4). Absolute harvest date is less important than the length of time the crop is in the ground.
Field conditions	Stressed plants are likely to be more susceptible to diseases, including black dot. **Manage water and nutrients to optimise plant health and growth.**	Further information can be found in AHDB publications, including: • *Irrigation and water use, best practice guide for potatoes* • *Nutrient Management guide (RB209), Potatoes, Section 5*
Chemical control	There are limited options available for the control of soilborne and seedborne black dot. Soil fungicide application should be considered only where the risk of black dot is assessed as high (or medium with additional risk factors). The efficacy of fungicide treatment is ultimately affected by disease pressure levels, field conditions and crop duration. **USE PESTICIDES SAFELY, ALWAYS READ THE LABEL. Always consult your buyer protocols before using any pesticides**	In trials, azoxystrobin applied in-furrow or incorporated into soil was shown to reduce black dot[9]. Any treatments should strictly follow label recommendations.
Storage	Provided skins have adequately set, it is advisable to **reduce the crop temperature immediately after harvest.**	Rapid pull-down to holding temperature during storage is particularly beneficial for higher risk crops (Figure 5). Aim for a 0.5°C pull-down per day to holding temperature. Adequate ventilation is required during pull-down to remove surface moisture. Further information can be found in the *Store Managers' Guide* 3rd edition.

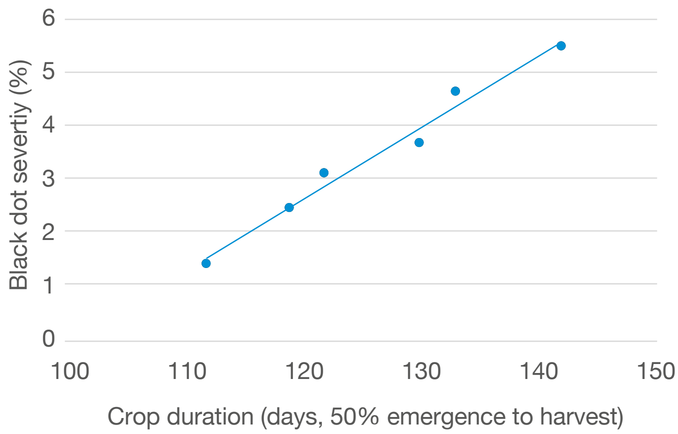

Figure 4. Effect of crop duration on the severity of black dot disease. Disease severity increases with increasing crop duration. This image was created by AHDB, based upon original work carried out by Peters et al. (2016)

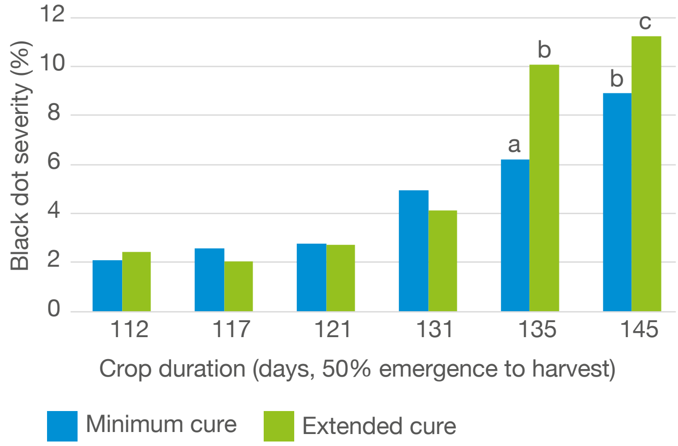

Figure 5. Effect of curing on disease development. Tubers were treated with either extended (14 days at 12°C) or minimum (4 days at 12°C) cure, prior to storage. Letters above bars show statistically significant differences between treatments. The effect of minimum curing is particularly evident at higher disease severity. This image was redrawn by AHDB, based upon original work carried out by Peters *et al*. (2016)

This edition of *Managing the risk of black dot* was revised by Laura Bouvet, Glyn Harper and Graeme Stroud (AHDB); Alison Lees and Jennie Brierley (James Hutton Institute). It is based on the 2008 version written by Kate Jackson et al.

Photography: AHDB, taken by Graeme Stroud

References

1. Lees A.K., Hilton A.J. (2003). Black dot (Colletotrichum coccodes): an increasingly important disease of potato. Plant Pathology 52: 3–12.
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6. Wale S. et al. (2008). Developing effective integrated control measures for the control of black dot. R249 project report. **potatoes.ahdb.org.uk/tags/black-dot**
7. Peters J.C. et al. (2016). The effect of post-harvest storage conditions on the development of black dot (Colletotrichum coccodes) on potato in crops grown for different durations. Plant Pathology 65: 1484–1491.
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Further reading

Johnson, D.A., et al. (2018). Potato black dot – the elusive pathogen, disease development and management. American Journal of Potato Research Doi:10.1007/s12230-018-9633-5.

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