Early Dormancy Break in Blighted Progeny Tubers

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Introduction

In several of the previous 10 years in the potato blight trial field at SAC, Auchincruive Estate, Ayrshire, Scotland, many actively growing King Edward plants were observed many weeks after the trials had been completely desiccated. These plants were not the result of re-growth due to ineffective desiccation because when some were pulled out of the ground in earlier years the new stems clearly originated from progeny tubers, not the stems of the desiccated plants. The reason for the early break in tuber dormancy and the growth of these new plants after the haulm of the original crop was dead was investigated in more detail in 2009.

Stems growing from blighted progeny tubers

Sprouted progeny tuber showing typical symptoms of blight

Methods

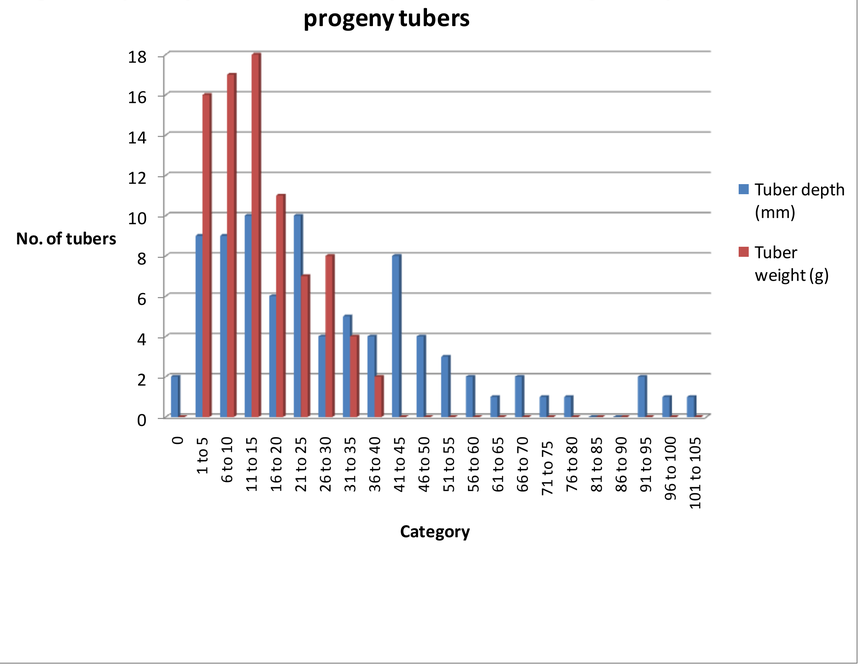
In early to mid-November 2009 83 actively growing King Edward plants were dug up from areas that had contained infector plants, not treated with fungicide. The severity (%) of blight on the tuber surface area, the weight of individual tubers and the depth of tubers in the soil were recorded.

Also, the plots of some treatments in a fungicide trial, that had been desiccated with 4 l/ha of a diquat product but not yet harvested, were assessed for the number of actively growing stems in each of the two centre rows. The cultivar used in the trial was King Edward and plots had been treated with fungicides known to have different efficacies in controlling tuber blight. The fungicides were Laminator Flo (mancozeb) @ 3.3 l/ha, Electis (zoxamide + mancozeb) @ 1.8 kg/ha, Shinkon (amisulbrom) @ 0.5 l/ha, Shirlan (fluazinam) @ 0.4 l/ha and Ranman A + B (cyazofamid + adjuvant) @ 0.20 + 0.15 l/ha. The untreated control was also assessed.

Results and Discussion

All 83 of the progeny tubers that had sprouted were blighted. This confirms the finding by Montarry *et al*. (2007) that tuber infection by *P. infestans* can induce early sprouting. In this study the extent of the tuber surface area that was blighted varied considerably but was generally high, i.e. greater than 20% (data not shown). The fact that two of the 83 emerged stems originated from progeny tubers with very little tuber blight suggests that it may be the location of the tuber blight relative to the eyes that is crucial and therefore early sprouting will be a function of both blight lesion location and size. Further experiments are also required to determine if premature sprouting of tubers can be induced by latent, i.e. pre-symptomatic, infection of tubers.

Fig. 1 Frequency distribution of depth in soil and weight of sprouted progeny tubers



Results and Discussion (continued)

As expected more of the blighted progeny tubers had been closer to the soil surface than deeper in the ridge (Fig. 1). However, premature sprouting was observed for 12 tubers that had been 12 cm or deeper. Tubers of a large range of sizes were blighted (Fig. 1). The average tuber size was small because the King Edward plants were not protected from foliar blight and therefore died relatively early.

Table 1 shows the current Euroblight ratings for direct control of tuber blight by the five fungicides and the number of emerged stems per row. The higher the Euroblight fungicide rating the lower the mean number of emerged stems. This inverse relationship was highly significant (R^2=0.93, *P*=0.008). Treatment with the four tuber blight fungicides Electis, Shinkon, Shirlan and Ranman TP resulted in significantly fewer emerged stems than the mancozeb treatment (F pr.= 0.010, LSD 1.29) but differences between the four fungicides with activity against zoospores were not significant.

There are several implications of blight-induced premature sprouting of progeny tubers in the field. For most crops with some tuber blight, harvest will take place before shoots from infected tubers can emerge therefore there isn't the risk of haulm produced by infected progeny tubers late in the season becoming blighted and being a source of inoculum to infect healthy tubers during harvesting.

Table 1 The number of stems emerging in late autumn from progeny tubers in desiccated field plots that had been treated with different late blight fungicides

Fungicide	Euroblight rating for tuber blight control	Mean no. of emerged stems per row
Untreated	-	2.1
Laminator Flo	0	2.4
Electis	++	1.0
Shinkon	++(+)	1.0
Shirlan	++(+)	0.6
Ranman TP	+++	0.0

The impact of blight-induced early sprouting is likely to be greater on the quality of the infected tubers, e.g. loss of moisture and loss of processing quality. Clearly the impact on the quality of the crop will be directly related to the number of infected tubers. In the fungicide experiment described above only stems that had emerged were counted. It is likely that other infected progeny tubers had sprouted but the sprouts had not yet reached the soil surface. The decline in quality associated with sprouting will be of little consequence for those tubers in which the blight causes an extensive rot because these tubers will be graded out. Establishing if premature sprouting is induced by latent infection, or very small lesions that fail to develop further, will allow the true relationship between the incidence of tuber infection and the effect of such infection on tuber quality parameters to be known.

Irrespective of the implications of this phenomenon for the risk of additional spread of blight in the field or tuber quality one aspect of the phenomenon is fascinating. There is now clear evidence from two independent studies that the pathogen *P. infestans* when it infects progeny tubers in the autumn can accelerate dormancy break and the production of stems. This contrasts sharply with the finding that the same pathogen inoculated into seed tubers prior to planting in spring can prevent or delay emergence, reduce the number of stems per plant and reduce plant height (Kelly, unpublished). Further experiments are necessary to determine if the different results obtained are due to the method of infection, time of infection and/or other factors.

References

Montarry J, Corbiere R, Andrivon D (2007). Is there a trade-off between aggressiveness and over winter survival in *Phytophthora infestans*? Functional Ecology 21, 603-610.

Acknowledgements

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