THE DEVELOPMENT OF CROWN ROT DISEASE ON CARROTS.

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INTRODUCTION

In recent years there has been a rapid expansion of both fresh and processing carrot production on the north-west coast of Tasmania. Crown rot is the most serious concern for carrot growers in Tasmania, and can severely downgrade or reduce carrot packout and profitability. Currently, there is no effective control strategy for this disease, due to a lack of understanding of its causal agent and epidemiology. Therefore, the aim of this study was to identify the cause of crown rot disease of carrots.

METHODS

Over a three-year period, crop monitoring, field inspection and sampling of paddocks were conducted prior to harvest. Disease diagnostic tests were conducted on carrots with crown rot disease to determine the cause of the rots. Koch postulate tests were conducted to confirm possible causal agents. Field factors that may be related to the development of crown rot disease, such as drainage, soil conditions, ground preparation, planting dates, varieties and crop rotations, were recorded.

RESULTS AND DISCUSSION

Studies conducted to date, showed that the disease symptoms were caused by different organisms or a complex of soil organisms, as well as different field conditions. There were variations in the types of crown rot symptoms that developed in different areas. In general, two distinct types of crown rots, smooth black crown rot and corky crown rot, have been identified in this study.

Fusarium was frequently isolated from carrots with crown rot infections that were collected after harvest from different properties. Species of *Fusarium* that have been isolated included *F. compactum, F. culmorum, F. reticulatum, F. semitectum* and *F. solani*. As *Fusarium* is ubiquitous in soil, and because there was a lack of consistency in the species isolated from crown rot carrots, *Fusarium* is believed to be mainly a secondary invader. Fungal inoculations on carrots conducted in a laboratory test, however, have shown that some species of *Fusarium*, especially *F. culmorum*, could cause smooth crown rot symptoms.

In 1996/97, the harvest assessment data of commercial crops by a major carrot packer, showed a significant relationship between the percentage of crown rot incidence and the percentage of *Sclerotinia* soft rot on carrots ($p = 0.003$; correlation coefficient, $r = 0.725$). This observation indicates that surface damage of crown rot areas caused by *Sclerotinia* rot may have pre-disposed the crown to secondary invasion by *Fusarium* species, resulting in the development of smooth crown rot.

Early field inspections and fungal isolations conducted on fresh specimens in 1998/99 season provided compelling evidence of the link between smooth crown rot and foliage diseases, especially *R. solani* and *S. sclerotiorum.* Either *R. solani* or *S. sclerotiorum*, causing both stem rot and crown rot, infected 20 crops out of 26 examined. *R. solani* and *S. sclerotiorum* were consistently isolated from crown rot affected tissues. In a field test, carrot crowns inoculated with agar blocks of *R. solani* showed early symptoms of smooth crown rot. Crown rot due to *R. solani* has been recorded in Canada (Mildenhall & Williams 1970).

High levels of *Rhizoctonia* infections were often associated with high levels of volunteer potatoes. When a high percentage of carrot foliage was infected by *Rhizoctonia*, a similarly high percentage of volunteer potatoes were also infected by the fungus. This suggests that the fungal isolates could infect both carrots and potatoes. Black sclerotes of *R. solani* found on some carrot main root surfaces, closely resembled black scurf due to *R. solani* which, is common on potato tubers.

High levels of trash on the ground promote *Sclerotinia* infections. Trash originates not only from a previous crop, but also from plant residues of herbicide sprayed weeds or mechanical damage of plants, which later becomes host to *Sclerotinia* infections.

R. solani and *S. sclerotiorum* were not associated with the other distinct crown rot symptom, corky crown rot. In field observations, the percentage of carrots with corky crown rot increased with the incidence of carrot scab due to *Streptomycetes*. As a result, corky rot also tended to be high when carrots were sown after potatoes. However, methods used to isolate *Streptomycetes* from common scab potatoes, have been unsuccessful for isolating actinomycetes from carrots. Other methods of actinomycetes isolation are being investigated.

High incidence of smooth crown rot often tended to be associated with wet field conditions, while high incidence of corky rot tended to be associated with dry conditions.

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