

Breeding for Disease Resistance in Potato

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I. INTRODUCTION

The potato (*Solanum tuberosum* L.) is one of the world's five most important food crops in both total production and area cultivated (FAO 1999). Yield losses due to disease are particularly high in potato, due in part to asexual propagation. An estimated 22% of potato yield is lost per year due to diseases and pests (Ross 1986). Based on a total 1998 world production of nearly 300 million tonnes (FAO 1999), this amounts to over 65 million t of potatoes destroyed annually by pathogens and pests. In addition, costs of pesticide application to prevent further loss are significant. For example, a single application of fungicide cost potato growers in the United States \$5–11 million in 1994 (Stevenson 1994). The cost for control of early blight alone in the United States and Canada in 1994 was estimated to be \$21–44 million. Furthermore, although pesticides are used heavily for potato production, government agencies continue to evaluate pesticide labels with the goal of reducing their use. Therefore, the development of disease resistant potatoes is becoming increasingly important in potato breeding programs.

Reviews of potato breeding strategies have discussed breeding for disease resistance (Ross 1986; Tarn et al. 1992; Bradshaw and MacKay 1994). However, tremendous progress has been made in recent years. For example, genetic mapping of a number of resistance genes has created interesting insights into the evolution of resistance, screening for pathogens has become much more refined with the use of the polymerase chain reaction and advanced immunological techniques, and the introduction of the A2 mating type of *Phytophthora infestans* into Europe and the United States has prompted a renewed interest in breeding for late blight resistance. Consequently, this review considers publications from the 1990s. A recent review of ploidy manipulations in potato breeding (Ortiz 1998) lists germplasm resources for disease resistance and genetic analyses of disease resistance traits, but does not discuss them in detail. This review emphasizes diseases of major concern in North America, most of which are serious problems worldwide. Other