

Walters, D. & Heil, M. (2007) Costs and trade-offs associated with induced resistance. **Physiol. Mol. Plant Pathol.** 71, 3-17

Abstract: Plants resist attack by pathogens and herbivorous insects through constitutive and inducible defences. Based on differences in signalling pathways and spectra of effectiveness, different types of induced resistance have been defined. Systemic acquired resistance (SAR) occurs in distal plant parts following localized infection by a necrotizing pathogen. It is controlled by a signalling pathway that depends upon the accumulation of salicylic acid (SA) and the regulatory protein NPR1. In contrast, induced systemic resistance (ISR) is induced by selected strains of non-pathogenic plant growth promoting bacteria (PGPR). ISR functions independently of SA, but requires NPR1 and is regulated by jasmonic acid (JA) and ethylene (ET). It is generally believed that induced resistance evolved to save energy under pathogen or insect free conditions, although costs still arise when defences are activated following attack. Costs can arise from the allocation of resources to defence and away from plant growth and development, and there are also ecological costs which result from trade-offs between induced resistance and the plant's interaction with beneficial organisms e.g. mycorrhizal fungi. To date, few studies have examined the costs and trade-offs associated with induced resistance to pathogens. There is a clear need for long term studies of costs and trade-offs associated with induced resistance in crops under commercial conditions. Without such information, the potential offered by induced resistance is unlikely to be realized.