Evolution of pathogen aggressiveness under a simplest host mixture

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Increasing genetic diversity of host populations through cultivar mixtures has been proposed and proved to be one of ecological and environmental friend approaches for plant disease management.

One major concern in cultivar mixtures is the possible emerging of "super races" or "super-aggressive races".

The objective of this study is to determine how infection efficacy evolves under the mixture of two cultivars.

Models

Figure 1 shows the flow diagram for the production, dispersion and deposition of spores from and on to a mixture of two cultivars. Pathogen increases its infection efficiency when it auto deposits back to the cultivar from which it is produced and decreases its infection efficiency when it re-deposits to another cultivar.

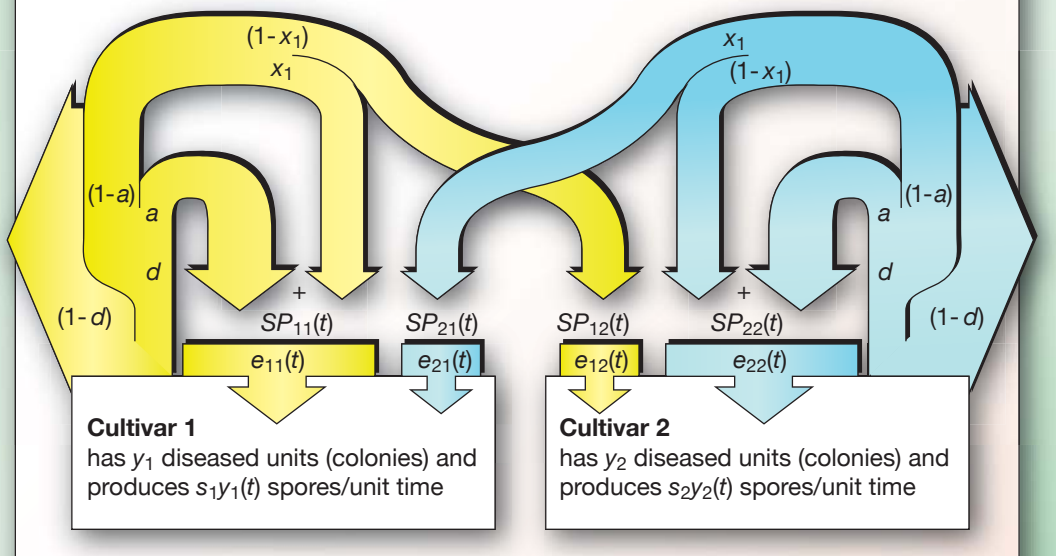

Fig. 1 Diagram shows the redistribution of spores produced from the diseased units on mixtures.

Results

Mixture of cultivars in any proportions tends to reduce the aggressiveness of pathogens at equilibrium but this effect decreases either when two mixture components are in extremely unbalance or are in closed proportions.

The evolutionary rates of aggressiveness and its value at equilibrium increase as auto-deposition rates increase.

The relative levels of initial resistances in mixture components do not have impacts on the aggressiveness of pathogens at equilibrium, but strongly influence transient values of the aggressiveness.

The rates between the cost of re-deposition and the benefit of auto-deposition did not affect the final outcome of aggressiveness but did affect the time of reaching its equilibrium.

Conclusion

Mixtures slow down the evolution of pathogen and prevent the emerging of super-aggressiveness.

Mixing 75% resistant cultivar and 25% susceptible cultivar could achieve the best effect in slowing down the evolution of pathogens