Pollination of 'Sundrop' Apricot

An Analysis of the effect of Self Incompatibility and Bloom Phenology on Fruit Set in Hawkes Bay

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To Mum who got me started,
Rosalind who kept me going,
and Charlotte who saw me finish.

For everything there is a season and a time for every purpose under heaven...
Ecclesiastes 3:1

Abstract

A range of observational, experimental and simulated data are analysed to discover how self incompatibility, relative bloom phenology and dormancy alleviation affect fruit set on 'Sundrop' apricot in Hawkes Bay. The derivation of two mathematical models, one of cross pollination, the other of bud development, provides a unifying theme to the study.

Controlled pollination experiments demonstrated that 'Sundrop' displays gametophytic self incompatibility. Pollen tubes from 'Sundrop' pollen generally fail to penetrate styles of 'Sundrop' flowers and this prevents fruit set under Hawkes Bay conditions. Study of apricot pollen tube growth at five constant temperatures between 5° and 25°C suggested that the penetration failure was not due to adverse temperature conditions since self pollen tube penetration was strongest at 10° and 15°C, temperatures typical of Hawkes Bay during apricot bloom. Field observations of honey bee foragers illustrated the strong influence that weather conditions have on honey bee foraging activity, but showed that activity on 'Sundrop' flowers is normally sufficient to achieve satisfactory cross pollination.

Analysis of bloom records indicated that relative times of bloom of apricots in Hawkes Bay and other North Island sites vary considerably from year to year. A simple model of pollenizer pollen transfer was therefore derived to estimate the optimum pollenizer bloom divergence for 'Sundrop'. It indicated 'Sundrop' should bloom slightly before (1-2 days) a pollenizer. Optimum divergence was most sensitive to the durations of pollen release and floral receptivity. Delayed pollination experiments showed that the duration of receptivity of 'Sundrop' flowers was the same as petal lifespan. Significant opportunity for cross pollination was still predicted when the pollenizer bloomed as late as six days after 'Sundrop'. By this criteria, 'Trevatt' (the most commonly-used pollenizer) appeared satisfactory under most, though not all, conditions.

The pollen transfer model indicated that relative bloom phenology needed consideration for selection of pollenizers for 'Sundrop'. However, the 'Utah' chill unit index was a poor predictor of dormancy alleviation and bloom for apricots under Hawkes Bay conditions. Hence, a model of low temperature-mediated alleviation of dormancy incorporating a progressive shift in bud temperature response was established based on an analysis of dormancy as the depression of a 'thermal response window' and chilling as a twofold seasonal signal controlling window size. Initial evaluation confirmed that the resulting PHYSHIFT model was highly flexible and could reproduce many of the responses that dormant buds of *Prunus* species display to constant and cyclic temperature regimes. Hence, the results suggest that the PHYSHIFT model may offer more reliable prediction of relative bloom timing for the purpose of pollenizer selection than chill unit models.

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