Self-Pollination and Its Implications in Peach Improvement

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Peach cultivars, with a few exceptions, are capable of self pollination (1). Hence, solid blocks containing many acres of a single cultivar will produce full crops of fruit. The exceptions, notably 'J. H. Hale', must be interplanted with another cultivar known to produce viable pollen if satisfactory cropping is to be attained. In all cultivars, however, some agent is necessary to convey pollen grains to the receptive stigmas for fertilization to occur.

Wind apparently is a minor agent for moving pollen in peaches; the pollen is relatively heavy and generally is not airborne (4). Some random drift of pollen from upper to lower branches may occur and may be aided by wind. Branches bagged to exclude insects have given commercially acceptable fruit set (15-20% of total blossoms) but usually much less than that obtained by open-pollination or by bagging plus hand-pollination (4). Bees of various types and other insects, in the process of collecting honey or nectar, are considered to be the primary agents in pollinating deciduous tree fruits (5).

Peach is said to be a highly heterozygous species (4). The nursery practice of clonal propagation maintains the heterozygosity of cultivars once they are obtained from controlled breeding, chance selection or mutation. One would not expect the degree of cross pollination found in wind-pollinated plants. Also, it is known that bees tend to collect pollen or nectar intensively in one tree before moving to another (5).

Few opportunities occur to test the degree of self-pollination under open-pollination conditions because distinctive marker genes are not present in the materials used. Controlled pollinations usually are used in breeding programs. However, open-pollination sometimes is useful to survey the range of variation in progenies from a female parent or to test a genetic hypothesis.

In two instances in our breeding program it has been possible to identify the portion of progenies coming from self-pollination under open-pollination conditions. The first was reported by Fogle and Dermen (2). A progeny obtained in 1968 from the green-leafed portion of a chimeral tree gave 60 green : 2 greenish-yellow seedlings, from which it was estimated that 86 percent self-pollination occurred. A small progeny in 1966 gave all green-leafed seedlings. Open-pollinated progenies obtained in 1966 and 1968 from the greenish-yellow portions of the same chimeral tree both gave good fits to 1 green : 2 greenish-yellow : 1 yellow, the ratio one would expect from self-pollination of the heterozygote, even though all surrounding trees were green-leafed. All progenies supported the conclusion that peach is highly sellf-pollinated under orchard conditions.

The second instance involved a progeny of 268 seedlings obtained from open-pollination of all flowers on an 'Empress' brachytic dwarf tree in 1975. Surrounding trees (all at 20-foot spacings) were normal in size except another, but smaller, 'Empress' tree. In the progeny, 210 seedlings were brachytic dwarfs and 58 were normal sized. The tall, normal allele is dominant over dwarfness in all recorded tests although modifying genes seem to give a restricted range of sizes among the dwarfs (4). The 58 normal seedlings, 22% of the total, could

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arise only from cross-pollination. Some additional cross-pollination could have occurred from the other 'Empress' tree. Assuming the same level of cross-pollination as that from the other seven surrounding trees, 75 percent of the progeny resulted from self-pollination.

The flight characteristics of bees and other insects offer at least a partial explanation of the high incidence of self-pollination in peaches. Honey bees have been observed visiting scores of blossoms in a tree, if nectar is plentiful, before moving to another (5). Honey bees have been observed ignoring the showy blossoms of a pollenless nectarine block to visit a few trees in which the rootstock had overgrown the scion. Nearby blocks of nectarines were visited intensively by the bees.

Asexual propagation of peaches dates back to about 1800 (3). As late as 1910, all peach cultivars originated as chance seedlings; some still do. From its probable origin in China in antiquity until the intensive breeding programs of this century were started, the peach progressed through countless sexual generations, with strong inbreeding pressures. Fortunately, distinct types evolved in different regions as the peach was disseminated. The Chinese Cling, the Chinese Honey, the Peento, and Spanish types supplied a germplasm bank that has been used widely in breeding programs for increasing cold hardiness and nematode resistance, decreasing chilling requirements, and improving many tree and fruit characteristics. The trend in peach breeding has been to a few highly productive breeding lines. This, inevitably, leads to further inbreeding and, potentially, to genetic vulnerability. The need for exploration for other peach germplasm before it disappears from its native habitats is urgent. Equally urgent is the need for support of efforts to preserve germplasm for future breeding programs.

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Distribution of Florida Peaches and Nectarines in the Tropics and Subtropics[1]

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The University of Florida peach and nectarine breeding program was initiated in the early 1950's to develop high quality early-ripening cultivars suitable for central Florida. This area is characterized by winters with 100 to 300 hours below 7°C (45°F). The earliest releases were mainly for home and local use but later ones have been utilized in commercial plantings (1, 2, 3, 4, 5). The success of this program has aroused widespread interest in other regions of the subtropics and tropics with similar climates. High-

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