Pollination and Fruit Set of Orchard Fruits
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Pollination and Fruit Set of Orchard Fruits

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This folder has been prepared for the purpose of answering some of the questions asked by those inexperienced in fruit growing. It is also intended as a guide for those who wish to make provisions for pollination in their plantings.

Pollination is the transfer of pollen from the anthers to the stigma of a flower (Fig. 1). If the transfer is from the anthers to the stigma of a

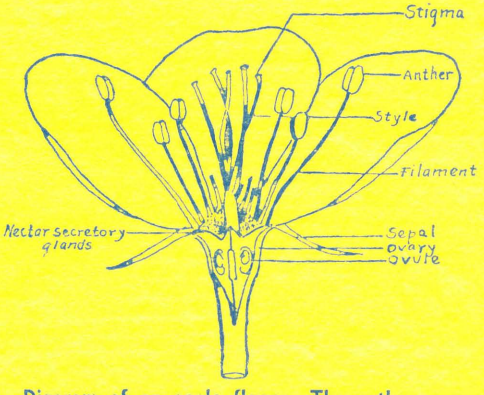

Fig. 1—Diagram of an apple flower. The anthers are made up of two sacs which hold the pollen. Pollination is accomplished when the pollen contained in the anthers has been transferred to the stigmas.

flower of the same variety it is *self-pollination;* if to the stigma of a flower of another variety it is *cross-pollination.*

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How Pollen is Carried

Fresh fruit pollen is moist and sticky. It is seldom, if ever carried by wind. It is transferred mainly by insects, especially honey bees, bumble bees and other bee-like insects. Of these the honey bee is most important, because it is best adapted as a pollen carrier, and its numbers can be most readily controlled in a given area. Usually best results will be obtained if hives of honey bees are located in or near an orchard.

Blossom Fertilization and Fruit Setting

Following pollination, the pollen grain usually germinates and produces a slender thread-like growth (the pollen tube). This tube grows downward through the tissues of the style and ovary to an ovule where the sperm (male element from the pollen) unites with the egg cell (female element in the ovule) in a process known as *fertilization.*

After fertilization, seeds form and the surrounding tissues of the ovary and adjacent parts of the flower are stimulated into growth to form the young fruit. *This is fruit-setting.* Further development of the fruit depends largely on the degree of blossom fertilization and the number of seeds formed. If fertilization is complete and all or most of the ovules natural to the fruit form seeds, the fruit should develop perfectly and is likely to remain on the tree until mature. Blossoms insufficiently fertilized either drop within a few days or develop into small lopsided or misshapen fruits, with few seeds.

Why Some Trees Fail to Set Fruit

Many varieties set little, if any, fruit unless their blossoms are fertilized with pollen of another variety. Such varieties are called *self-unfruitful* and require cross-pollination with suitable varieties to insure a set of fruit. Varieties which set fruit with their own pollen are called *self-fruitful.*

Some varieties will not set fruit even when cross-pollinated with other particular varieties of their own kind. They are *cross-unfruitful. If* neither of two varieties will fertilize the other, they are said to be *inter-sterile* or *inter-unfruitful* and *incompatible* with each other. Varieties which set fruit when pollenized with each other are said to be *compatible* and *interfruitful.*

Factors other than pollination which may influence the set of fruit are:

1. Winter injury to dormant blossom buds.
2. Frost damage to blossoms in the spring.
3. Extremely weak trees caused by overbearing, unfavorable growing conditions, defoliation by insects and diseases.
4. Over-vigorous trees.
5. Poor nutrition, especially lack of nitrogen and moisture during the blooming period.
6. Diseases such as brown rot of stone fruits, apple scab, fire blight (often called blossom blight).
7. Insect damage to blossoms.
8. Temperature too low for pollen tube growth.

Any of these factors may prevent or seriously reduce the fruit set, but in general when a healthy tree blossoms heavily and few blossoms set fruit poor pollen distribution or lack of adequate cross-pollination may be suspected.

Vigorous young trees which do not blossom and bear fruit may not be of bearing age. Some varieties such as the Northern Spy apple do not begin to blossom until they are 10 or 12 years of age.

Provide for Cross-pollination

The best time to make provision for cross-pollination is when the orchard is planted. Never plant self-unfruitful varieties singly or in solid blocks. Further, varieties which are considered self-fruitful or nearly so, often set more fruit when cross-pollinated with other varieties.

In large orchards two to four rows of one variety may be planted together, followed by an equal number of rows of another variety, or, every third row may be planted to a pollenizing variety. If a minimum number of pollenizers is desired every third tree of every third row may be of the pollenizing variety. When this is done, start the planting of the pollenizers at the position of the second tree in the second row. For convenience in

spraying and harvesting, as many trees of one variety should be planted together as can be adequately cross-pollinated.

The varieties planted together should 1) have about the same blooming season and 2) come into bearing at about the same age. Varieties selected as pollenizers should 1) be compatible with the variety to be pollinated, 2) produce a large amount of viable pollen and 3) be an annual bearer or at least bear some blossoms every year.

Avoid using a variety both as a pollenizer and a filler for a permanent variety. Provision for pollination should be made among the permanent trees so that the removal of filler trees will not bring about a lack of pollination.

Planting Vacancies—In young orchards where too many trees of one variety have been planted, provision for cross-pollination may be made by planting vacancies which may occur to a good pollenizing variety.

Top Grafting—In established orchards pollenizers may be introduced by grafting. In young orchards where there are few vacancies every third tree in every third row may be grafted to a pollenizing variety. In large, mature trees graft several branches high up in each tree, preferably in the south or southeast portion of the tree.

Use of Bouquets—Where no other provision for pollination has been made, branches or bouquets of opening blossoms from trees of suitable pollenizing varieties can be placed in tubs, buckets or barrels of water between the rows close to the trees. When small branches are used the containers should be elevated several feet above the ground so that the blossoms of the bouquets and those of the trees intermingle. Best results will be obtained if the bouquets are placed in buckets and hung high up in the outer extremities of the trees. At least two or three bouquets should be hung in each tree. In large mature apple and sweet cherry trees four or more bouquets should be used. If weather conditions are unfavorable for bee visitation over a period of several days, fresh bouquets may be needed if the blossoms become wilted or unattractive.

Use of Honey Bees—Bees are necessary for successful pollination. In home orchards or in small commercial plantings of mixed varieties where wild insects are abundant a satisfactory set of fruit may be obtained without the use of honey bees. In large orchards or in areas where there are not enough wild insects for adequate pollination hives of honey bees should be placed in or near the orchard. More bees will be required in orchards of mature trees than when the trees are young. One strong colony for each acre of mature trees is the minimum requirement. The hives should be placed singly and rather uniformly distributed among the trees. In orchards exposed to high winds bee flight may be stimulated by placing the hives in groups of two or three in the more sunny and sheltered locations.

Strong over-wintered colonies are best. Weak colonies may be strengthened by the addition of package bees early in the spring. Package bees are not dependable as they frequently do not provide enough field workers for effective pollination.

Apple Pollination

Most varieties produce better crops if provision is made for cross-pollination. At least three varieties should be planted in an orchard to insure a set of fruit in off-years and during seasons unfavorable for pollination.

A few varieties such as Baldwin, Rhode Island Greening, Winesap, Stayman, Turley, Gravenstein and Stark produce little or no good pollen and are not only highly self-unfruitful, but are worthless for pollenizing other varieties. If any one of these is planted, it should be interplanted with two other varieties that produce good pollen.

Delicious, Golden Delicious, Tolman Sweet, and Steele Red are especially good pollenizers for other varieties. Other good pollenizers are Duchess, Grimes, Jonathan, McIntosh, Northern Spy, Rome, Wagener and Wealthy.

Delicious and its red strains (Starking and Richared), McIntosh, and Northern Spy often do not set good crops regularly when more than two rows are planted together. If only one of these

varieties is planted there should be at least two other good pollenizing varieties in the orchard. If two of the three varieties are planted there should be at least one other good pollenizing variety in the orchard. Good pollenizers for Delicious are Jonathan, Wealthy, McIntosh, Golden Delicious, Grimes and Steele Red; for Northern Spy, Tolman, McIntosh, Wealthy, Steele Red, Delicious and Rome.

Duchess and other early blooming varieties are not satisfactory pollenizers for Northern Spy or other late bloomers, because in some seasons there is not enough overlapping of blooming seasons. Usually there is enough overlapping between Northern Spy and mid-season blooming varieties such as Jonathan and McIntosh. Likewise, there is enough overlapping of seasons with Duchess and mid-season blooming varieties.

If an early-bearing variety such as Jonathan is planted with Northern Spy or other late-bearing varieties, another early-bearing variety should be planted with it to serve as a pollenizer until the Northern Spy begins to produce blossoms.

Red sports of several varieties are interunfruitful with each other and with the parent variety. Examples of these are Starking and Richared, red sports of Delicious; Red Spy, a sport of Northern Spy; Jonared and Blackjon, sports of Jonathan. Whenever two such varieties are planted a third variety that is known to be a good pollenizer for them should be included in the planting.

Cherries

Sweet Cherry — All varieties highly self-unfruitful. Further, Bing, Lambert and Napoleon are interunfruitful. No one of these should be planted without providing some other variety as a pollenizer. Black Tartarian, Schmidt and Windsor are effective pollenizers for any one or more of these three defective varieties. Windsor, Schmidt and Bing are interfruitful and any one of them is an effective pollenizer for either of the others in the group. Windsor and Black Tartarian seem to be better than other varieties for interplanting with Bing or Napoleon. Bing, Napoleon and Black Tartarian are about equal in their usefulness as pollenizers for Windsor.

Sour Cherries—All varieties commonly grown in Michigan are self-fruitful. Good crops can be expected from solid plantings of one variety.

Duke Cherries—May Duke, Royal Duke and Late Duke are partially self-fruitful. Larger crops are obtained if they are cross-pollinated with a sweet cherry variety such as Windsor or Napoleon. Duke varieties are poor pollenizers for sweet cherries, and it is advisable to have a tree of each of two compatible sweet cherry varieties in a home planting of Dukes. Sour cherry varieties will pollenize the Dukes, but in some years there is not enough overlapping of blooming seasons.

Peaches, Apricots and Nectarines

Most varieties of peaches commonly grown in Michigan are self-fruitful and may be planted in solid blocks of one variety. J. H. Hale, Mikado (June Elberta), Hal-Berta, Candoka and Welcome are self-unfruitful. Hale Haven and South Haven are the best pollenizers for J. H. Hale. Most other varieties, except possibly Elberta, also seem to be good pollenizers for this variety. Not more than two rows of J. H. Hale or other self-unfruitful varieties should be planted together. All common varieties of *apricots* and *nectarines* seem to be self-fruitful.

Pears

All common varieties produce good pollen, but most of them are highly self-unfruitful. Flemish Beauty and Conference seem to be self-fruitful, but larger yields will be obtained if they are cross-pollinated with other varieties.

Bartlett and Seckel are interunfruitful. Neither is a satisfactory pollenizer for the other. If these two varieties are desired in a planting a third variety is necessary to pollenize them.

Howell, Bosc, Conference, Clairgeau and Flemish Beauty are generally satisfactory pollenizers for other pear varieties. Bartlett and Seckel are good pollenizers for Bosc, Flemish Beauty, Howell and Kieffer.

Plums

European — At least two varieties should be planted in an orchard. A few varieties such as Stanley and Monarch are quite highly self-fruitful, but these will set better crops if interplanted with other varieties. Italian Prune, German Prune and Reine Claude (Green Gage) are sometimes self-fruitful and sometimes self-unfruitful. Albion, Arch Duke, Bradshaw, Diamond, Grand Duke, Hall, Imperial Epineuse, Pond, Tragedy and others are definitely self-unfruitful and should never be planted alone. Pollenizers for European varieties should be other varieties of the same species.

Japanese — Most varieties are highly self-unfruitful. Both Burbank and Abundance which are most commonly grown are self-unfruitful, but are dependable pollenizers for each other. European varieties are unsatisfactory pollenizers for Japanese varieties.

Damsons — Both Shropshire and French are self-fruitful and may be expected to produce satisfactory crops without cross-pollination. Shropshire is a satisfactory pollenizer for certain European varieties particularly Albion, Hall and Stanley.

American — All varieties are highly self-unfruitful. It is advisable to plant at least two varieties. Varieties that are hybrids of American and Japanese species are also self-unfruitful.

Quince

All varieties commonly grown are sufficiently self-fruitful to set satisfactory crops with their own pollen.

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