FS 172
Reprinted June 1981

Stone Fruit Pollination

Prepared by W. P. Stephen and D. M. Burgett, entomologists, and
J. Capizzi, Extension entomologist, Oregon State University, Corvallis

Cherries, prunes, plums, and peaches make up the common stone fruits produced commercially in Oregon. All varieties of sweet cherries, most Japanese and European varieties of plums, and some peach varieties, such as J. H. Hale and Alamar, are self-unfruitful—that is, they are unable to set and mature a commercial crop when self-pollinated. Italian prunes and most peach varieties are self-fruitful—they will set a commercial crop when self-pollinated.

Optimal pollination depends on several factors, each of which may be limiting if not met. These include preparation of the orchard prior to the introduction of pollinators, good bee management practices, and favorable weather conditions during bloom period.

Orchard management for self-unfruitful varieties

Pollinizer requirements. To insure consistent commercial yields of the self-unfruitful varieties, adequate numbers of compatible pollinizer trees must be interspersed with the variety to be pollinized. Both the number of pollinizers and their placement should be determined by weather conditions that normally prevail during the blooming period as well as by foraging behavior of honey bees. A pollen-collecting honey bee will usually visit only two or three adjacent trees during a single foraging trip. Therefore, if pollen is to be efficiently transferred from the pollinizer variety to the blossoms of the variety to be pollinized, different varieties must be closely spaced.

An optimal arrangement is to have every other tree in every row a pollinizer. This presents harvesting difficulties, however, and is often impractical if the fruit of the pollinizer variety has relatively little commercial value. A recommended compromise is every third tree in every third row be planted to the pollinizer variety. This provides for each tree of the commercial variety to be adjacent to one pollinizer.

Competing bloom. Many weeds common to orchard floors, such as dandelion and chickweed, are often more attractive to bees than is the orchard bloom. In addition, when bees are moved into an orchard from an area where a particular weed predominates, they usually resume collecting nectar and pollen from the same or a related species at the new location. Honey bees may become readily conditioned to a weed such as dandelion, and few bees will change to fruit even when dandelion flowers cease yielding at midday. Thus competing bloom, both in and adjacent to an orchard, not only competes for bee activity, but also presents a hazard in that it accumulates large amounts of pesticides that have been applied to the orchard prior to the time the bees were moved in. Mowing or disking an orchard floor immediately prior to the introduction of bees is a recommended practice.

Insecticides. Most pesticides applied for control of orchard pests are highly toxic to honey bees. Every precaution should be taken to protect pollinators during the pollination period. Only those pesticides recommended by the county Extension agents should be used, and these should not be applied while bees are in the orchard. Loss of honey bees during the bloom period creates a serious hardship for the beekeeper and deprives the orchardist of the service for which he is paying.

Weather and bee activity

Honey bees are temperature and light sensitive and rarely will fly if the temperature is below 55°F and the wind is more than 15 to 20 mph. The stronger the colony, however, the lower the temperature at which the bees may initiate flight. Thus a strong colony is usually worth several weak colonies as pollinators. In poor weather when flight conditions are marginal, bees foraging at more distant locations will remain in the hive and only those bees that have been foraging nearby will be active. Therefore, where inclement weather is the rule during bloom period, colonies of honey bees should be placed uniformly throughout the orchard in order to benefit from the more frequent, shorter bee flights. This type of service, however, is time consuming and costly to the beekeeper and requires additional compensation.

Both nectar and pollen collectors are most active between the hours of 9 a.m. and 1 p.m. Of the two types of bees, the pollen collectors are the most efficient pollinators. An individual honey bee

OREGON STATE UNIVERSITY
EXTENSION SERVICE

Extension Service, Oregon State University, Corvallis, Henry A. Wadsworth, director. Produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U. S. Department of Agriculture, and Oregon counties. Extension invites participation in its programs and offers them equally to all people.

forager may collect pollen one day and nectar the next or pollen on one foraging trip and nectar the next. Generally, a good nectar flow or supplemental feeding with sugar syrup stimulates an increase in the number of bees collecting pollen.

Bee Management

Introduction of the bees. Bees should be moved into cherry orchards as soon after the start of bloom as possible, for cherry blossoms must be pollinated shortly after they open. With plums, bees should not be introduced until the pollinizer and the variety to be pollinated are in at least 25 percent bloom. Moving bees into an orchard prior to bloom will result in establishment of the field force at pollen and nectar sources other than the fruit to be pollinated. Introduction of bees into an orchard free of blooming plant competition, and in which fruit is in at least 25 percent bloom, usually results in the entire field force visiting trees adjacent to the hive in the process of reorientation.

Number of colonies required. There is an established general rule of thumb that one good colony of honey bees per acre is satisfactory for tree fruit pollination. Some consideration, however, must be given to tree size, pollinizer placement, competition both within the orchard and without, and weather conditions normally experienced during the bloom period. Whereas one colony of bees per acre is routinely used in many of the sweet cherry producing areas of Oregon, with good management many growers in the Willamette Valley are regularly achieving high yields when using four colonies to the acre. Two to four colonies per acre are recommended for areas such as Union County where inclement weather conditions are common during bloom. One colony per acre appears to yield satisfactory results in plums and peaches.

Spacing of colonies in the orchard. When colonies are introduced into an orchard at the rate of one colony per acre, optimal pollination is achieved when the bees are located in groups of four spaced uniformly throughout the orchard. Such placement is often impractical because of weather conditions at the time of bee introduction or because of the contour of the land on which the orchard is located. Generally, beekeepers will cooperate in spacing colonies throughout the orchard in groups of six to eight per location, but will charge an additional fee for the location of smaller groups. Where pollination is a consistent problem, growers may find it economically profitable to pay up to twice the normal rental fee for bees spaced in groups of two to four throughout the orchard.

Colony strength. Standards of colony strength for bees used for commercial pollination purposes have been established by the legislature and appear in Section 55-005 of the Oregon Administrative Rules. In addition to freedom from bee disease, the rules state that each colony should contain 3,000 square inches of comb, with 600 square inches occupied by live brood; contain enough bees to cover six standard Hoffman frames or their equivalent; have a laying queen; and 10 pounds of honey. An efficient pollination hive should have a minimum adult population of 30,000 bees. A colony this size will have a foraging force of from 10,000 to 13,000 bees. Larger colonies possess disproportionately larger numbers of foraging bees. Orchardists usually have neither the time nor inclination to inspect all of the colonies provided to them and must rely on the rental of bees from reputable beekeepers.

Removal of bees. Weather conditions during the bloom period should determine when bees are to be removed from the orchard. During good flight weather a pollen-collecting bee will visit from 10 to 20 flowers per minute. A uniform distribution of only four pollen collectors per tree throughout the orchard would result in 2,400 to 4,800 floral visits per tree every hour. Thus it is understandable why good commercial yields of fruit have been realized during seasons when there was but a single day of good flight weather during the blooming period. In seasons of good flight weather, when the pollinizer and the variety to be pollinated have bloomed synchronously, bees may be removed well before one-third of petal fall has occurred. In seasons of adverse weather conditions, however, bees should be left in the orchard until petal fall is almost complete. Colonies used in pollination produce no surplus honey while in the orchards and bees kept unduly long in a spent orchard suffer severe losses in honey and bee strength.

Artificial pollination

Use of pollen inserts to effect cross-pollination and application of pollen through the use of a speed sprayer have not given consistently good results in Oregon tests. The application of pollen by brush to individual flowers or by hand duster to flower clusters is a satisfactory means of pollination, but it is slow and expensive.

Contract agreements

A written contract between beekeepers and orchardists does much to prevent misunderstanding and thus insures better pollination service. The following points should be covered:

- Date of movement of bees into the orchard, or the time relative to a certain condition of bloom, and the date the bees are to be removed.
- Colony strength to meet standards agreed on by the beekeeper and orchardist.
- Pattern of colony placement in the orchard.
- Rental fee and the date(s) on which it is payable.
- Orchardist agrees not to apply bee-toxic pesticides while bees are in the orchard, but if necessary to do so, the beekeeper will be given 48 hours notice.
- Orchardist agrees to reimburse the beekeeper for additional movement of colonies in, out, or around the orchard.
- Orchardist will provide the right of entry of the beekeeper for the management of the bees.
- Beekeeper is obligated to inspect the colonies to be sure they are queen-right and in good condition when bees are kept in a given orchard for more than 2 weeks.