



Almond flowers are most receptive to effective cross pollination for a day or two after they open and remain receptive for only three or four days, under favorable weather conditions.

# *Timing*

*is critical for*

## **EFFECTIVE CROSS POLLINATION OF ALMOND FLOWERS**

**A**LMOND GROWERS frequently ask how long almond flowers can be effectively cross pollinated after opening. All almond varieties grown in California require cross pollination by honeybees to produce a crop. Since the important almond varieties usually start blooming during warm weather in February, the bloom period is often interrupted and prolonged by inclement weather. During these intervals pollinizing insects may not be active and any flowers that were open but not cross pollinated before the severe weather are lost unless they remain receptive until the weather is again favorable for insect activity. The cross pollination of flowers that open during periods of warm rains or strong winds may also be delayed.

Eight branches were tagged on each of three mature Nonpareil trees in the University orchard at Davis to determine the length of the period of receptivity of almond flowers. The flowers on one branch on each tree were counted to give the percentage of fruit set resulting from natural cross pollination. The Nonpareil trees were interplanted with pollinizing varieties and an adequate supply of honeybees was provided. Flowers on the remaining branches were emasculated February 20, 1963, when most were in the "popcorn" stage with the petals near full size, but not yet separated to open (see illustration).

During favorable weather, such flowers will open in from one to three days. In the emasculation procedure, the petals, anthers, and most of the floral tube are removed, leaving the pistil exposed. Since pollinating insects are only attracted to the resplendent flower parts, the emasculated ones are safe from uncontrolled pollination.

The emasculated flowers on one of the branches on each tree were used as controls (not pollinated). Flowers on the other branches were cross pollinated with Jordanolo pollen, known to be cross compatible with Nonpareil, after different intervals of time, as shown in the table. The pollen was obtained by removing the anthers from Jordanolo flowers and holding them in the laboratory until they shed their pollen. The pollen was applied to the stigmas of the emasculated Nonpareil flowers with a fire-polished glass rod.

Weather throughout the pollination and fruit setting period of the Nonpareil almond was ideal for the experiment. On February 20 the minimum temperature

was 49°F and the midday temperatures ranged in the high 60's with a maximum of 69°F. The mild weather continued and there was no rain until March 7. Frosts occurred March 15 and 18, but the developing fruit was not injured. The percentages of fruit set were based on final counts made on May 13, after the normal period of fruit drop.

The blossoms that were cross pollinated February 23, three days after emasculation, gave a significantly higher fruit set (30.2%) than those under any of the other treatments (see table). Since the flowers were emasculated from one to three days before they would have opened normally, February 22 could be considered the average date of flower opening. Cross pollination on February 23, three days after emasculation, was comparable, therefore, to cross pollination one day after normal flower opening. Apparently, this was the time the pistil was most receptive. When cross pollination was delayed until February 25, five days after emasculation (comparable to cross pollination three days after normal flower opening), fruit set was significantly reduced. When flowers were not cross pol-

EFFECT OF TIME INTERVAL BETWEEN BLOSSOM OPENING AND CROSS POLLINATION ON FRUIT SET OF NONPAREIL ALMOND FLOWERS, 1963

| Treatments/on each of three trees     | Days between emasculation and pollination | Number of flowers under test | Number of fruit set per 100 flowers (May 13) |
|---------------------------------------|---|------------------------------|--|
| Natural pollination                   | -   | 833                          | 20.1   |
| Emasculated controls (not pollinated) | -   | 586                          | 0.0  |
| Date emasculated                      | Date cross pollinated                     |                              |  |
| Feb. 20                               | Feb. 20                                   | 326                          | 18.4   |
| Feb. 20                               | Feb. 21                                   | 441                          | 18.3   |
| Feb. 20                               | Feb. 23                                   | 386                          | 30.2   |
| Feb. 20                               | Feb. 25                                   | 375                          | 21.2   |
| Feb. 20                               | Feb. 27                                   | 415                          | 1.1  |
| Feb. 20                               | Mar. 1                                    | 410                          | 0.5  |

inated until seven or more days after emasculation (comparable to five or more days after flower opening), fruit set was practically nil.

Flowers cross pollinated the same day they were emasculated, February 20, or one day later, February 21 (comparable to cross pollination two days and one day before the flowers would have opened), gave lower fruit sets than those pollinated February 23. This showed a lower receptivity of immature almond pistils to pollen germination and fertilization.

The results indicate that under weather conditions favorable for natural cross pollination, almond flowers are most receptive to effective cross pollination for a day or two after they open, and remain receptive for only three or four days. The results also corroborate the conclusions of previous workers regarding the length of the period of receptivity. For example, tests with the apple have shown that pollination must occur within two to four days following the opening of a flower, if a high percentage is to set fruit.

Previous studies at Davis have shown that any reduction in total number of almond flowers due to frost, disease or insect attack, caustic sprays, etc., or reduction in the proportion of flowers cross pollinated, causes a reduction in the final fruit set and yield. Although the almond normally produces many more flowers than develop into mature fruit, the loss of a portion of the flowers or the failure of a portion to be cross pollinated is not adequately compensated for by an increase in the set of those remaining. For maximum crops, therefore, essentially 100% of the flowers should be cross pollinated.

Since a profitable almond crop depends upon cross pollination of practically all flowers, and each flower is receptive for only three or four days, it is essential that the grower maintain adequate combinations of cross-compatible varieties and provides an abundant supply of honeybees. The importance of strong colonies of honeybees for the almond orchard cannot be overemphasized since almonds bloom at a time when temperatures favorable for effective bee activity are generally restricted to one to three hours at midday.

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Flowering shoot of the almond, to left in drawing, shows third and fourth blossoming buds from the tip are in the "popcorn" stage and ideal for emasculating. Emasculated almond flower showing exposed pistil and base of the floral tube, and peduncle, is seen to right above. Lengthwise section of almond flower is seen to right, below.

