Avocado Productivity: Pollination, Pollenizers, Fruit Set and Abscission.

Ehud Katz

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Abstract

In Israel, as in many other countries, avocado production is low and erratic. In this research we studied factors responsible for fruit set and fruit drop. We concentrated on four aspects:

1. Abiotic pollination, its rate and significance.

2. Fertilization and fruit set after pollination at the male opening stage.

3. Searching for effective pollenizers by observing initial fruit set after hand-pollination.

4. Using auxins to increase fruit set and reduce early fruit drop

Abiotic pollination, its rate and significance

For the past 25 years, avocado trees have been caged to prevent cross-pollination. In the last decade, however, this assumption has been invalidated. Isozyme analysis of fruit embryos from caged trees has proven that cross-pollination does occur. In addition, a considerable number of fruits have been found on very fertile cultivars, such as 'Tova' and 'Gwen', when caged without pollinators. A possible explanation for this phenomenon is Abiotic pollination.

We sampled hovering pollen grains using microscopic slides smeared with silicon grease and Rotorod Samplers, near the inflorescences and 3 m from trees in full bloom. In addition, we determined the pollination rate of flowers from small, caged trees located near mature, blooming trees, from mature caged trees, and from trees exposed to pollination by pollinators. Our results confirm that avocado pollen does hover in the air, usually in clusters. We found a considerable difference among cultivars in the amount of hovering pollen. The greatest amount of pollen was found near 'Ettinger' trees, to as far as 25 m away; moderate amounts were found near 'Fuerte' and 'Reed' trees, and very little was found near 'Pinkerton' trees. We calculated the probability of a cluster of pollen grains landing on an avocado flower stigma, based on the assumption that 100,000 flowers per tree are exposed to hovering pollen. We found that for cvs. 'Pinkerton', 'Reed', 'Fuerte' and 'Ettinger', 9, 32, 90, and 413 flowers, respectively, could be pollinated in this way during the flowering season. It was also found that a pollen cluster from the same tree could reach the stigma of 4, 10, 16, and 136 flowers, respectively, on a tree 3 m away. These pollination rates could explain the phenomenon of spontaneous fruit set in caged trees.

Although Abiotic pollination in avocado does not contribute significantly to yield, when pollinators are absent it may be responsible for low fruit set and for the occurrence of

hybrid fruits on caged trees

Pollination, fertilization and fruit set after pollination at the male opening stage

The avocado flower opens twice. At the first opening it functions as female: the pistil and the stigma are receptive and no pollen is shed. At the second opening it functions as male: the pollen sacs open and pollen is released. When pollen reach the stigma at this second stage, fertilization and fruit set were found not to occur. Recently, however Davenport (1994) has claimed that in Florida, pollination which leads to fertilization and fruit set usually occurs during the male opening stage. His conclusions were in contrast to Shoval's (1987) findings that in Israel, after pollination during the male opening stage, of most commercial cultivars, pollen tube growth is arrested in the style and does not reach the ovule, eliminating any possibility of fertilization and fruit set. We re-examined the result of pollination at the male opening stage in cvs. 'Ettinger' and 'Reed' and in three cultivars with West Indian "blood" ('Simmonds', 'Ein-Harod' and ' Maoz'). Following hand-pollination at the female opening stage, pollen tubes usually reached the ovule and initial fruit set occurred. However following pollination at the male opening stage, no pollen tubes reached the ovule and there was no set of normal fruitlets. Our results support the conclusion that under Israeli climatic conditions, pollination at the male opening stage does not lead to fertilization and fruit set.

Searching for effective Pollenizers The tendency for cross-pollination to increase yield, especially if the pollen donor is potent, is well known. In our hand-pollination experiments we tested new cultivars which could potentially become commercial as pollenizers, and found some promising candidates: 'Green gold' and 'Ardith' for 'Ettinger' 'Ettinger', 'Irit' and 'T-142' for 'Ardith' and '104-Red Lable' and 'Irit' for 'Reed'. However these conclusions should be considered preliminary awaiting further testing in commercial orchards. Hot spells had a pronounced deleterious effect on many of our experiments, whereby pollination that occurred 7 days before a "Hamsin" (a climatic condition characterized by hot, dry days) did not result in fruit set.

Using auxins to increase fruit set and reduce fruit drop In avocado, massive fruit drop occurs during the first month after fruit set. We tested the effect of synthetic auxins on fruit set and fruit drop. Application was begun at full bloom and then again 3 weeks later. We tested three commercial products: Tipimon (active ingredient: 2,4,5TP), Hadranol (active ingredient: 2,4-D) and Alphanol (active ingredient: NAA). Tipimon caused great damage to fruitlets and to vegetative growth. Severe burns were noted following treatment with concentrations of 50 ppm and higher; burns were also seen in inflorescences treated with the low concentration of 10 ppm. All treatments with Tipimon brought about a drastic decrease in the number of fruitlets and fruit. We concluded that avocado is very sensitive to Tipimon.

Alphanol also caused damage to vegetative growth and increased fruit drop. Hadranol, at concentrations of 200-1000 ppm, caused damage, which was expressed as burns and fruit drop. However, low to moderate concentrations (10-50 ppm) of this product usually increased yield, significantly in some experiments. These positive results justify large scale orchard experiments with Hadranol.