

Effect of extreme temperature regimes and different pollinizers on the fertilization and fruit set processes in avocado

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Extremes of temperature during the flowering and fruit-set season are considered to be among the main factors limiting avocado productivity. In this research we studied the effect of temperature and pollen source on the fertilization processes and early fruit-set. All experiments were begun with hand pollination of either excised or intact flowers.

The effect of temperature on pollen viability

Mature pollen did not lose its viability after exposure to 0-1°C for 6-10 hours. Furthermore the viability of mature pollen kept at 0-5°C, was higher than that of pollen kept at 12-15°C. No decrease in pollen viability was found after flowering nursery trees were kept for 7 days at temperature regime of 15°C day/5°C night.

Viability of orchard pollen was found to be poor at the beginning of the 1983 flowering season. In contrast, viability of pollen produced under optimal temperature regime (in the phytotron) was high throughout the flowering season. In our opinion, the orchard pollen was damaged because it developed under the continuous cold climate of the 1983 winter.

Exposure to high temperatures (34°C or more) for several hours affected adversely the viability of mature pollen. Pollen exposed to 39-40°C lost its ability to reach the embryo sac. A scanning electron microscope study showed that high temperature caused shape distortions in the pollen grains.

The effect of temperature on the fertilization process, fruit-set and fruitlets abscission

The fertilization process and the early fruit-set were not damaged by exposure to low temperature. Even when temperature dropped to 5°C for 3-4 nights, 6-9 hours each night, no decrease was found in fruit-set of 'Ettinger' and 'Fuerte' nursery trees. No damage was found even when the cold temperature was started immediately after the pollination and lasted during the whole fertilization process. Similar observations were also obtained in orchard experiments. Therefore, in our opinion low night temperature occurring regularly in the orchard during most of the fruit-set season are not a limiting factor of avocado fertility.

High temperature clearly damaged the fertilization and fruit-set processes. Temperature of 32°C day/22°C night lasting for three weeks from the day of pollination reduced fruit-set in 'Fuerte' nursery trees. Temperature of 38-39°C day/ 20-22°C night for 2-4 days starting at different times after pollination severely damaged the fertilization and fruit-set processes in all the varieties examined. We found that the closer the temperature stress is to the time of pollination, the more severe is its effect. It seems that the fertilization process is highly sensitive to high temperature. Different cultivars displayed different sensitivity to high temperature. In our opinion, high temperature at the time of early fruit-set is a crucial negative factor in determining avocado yield.

The effect of pollen source on the fertilization process, fruit-set and fruitlets abscission

Pollen source was found to greatly affect the rate of fruit-set and the size of the fruitlets. 'Ettinger' was found to be an efficient pollinizer of 'Fuerte' and 'Hass'; 'Fuerte' set after being pollinated with 'Ettinger' pollen was found even to exceed the set achieved by 'Topa-Topa' pollen. 'Semil-43' and 'Day' - hybrid cultivars with West-Indian "blood" - were also found to be efficient pollinizers, even under climatic conditions where other pollinizers affected poor setting. In contrast, the pollen of 'Horshim' and 'Hass' had a low set ability. As for 'Hass', we encountered difficulties in transferring its pollen grains to the stigma. However, besides this technical difficulty we believe that there is a problem of low viability which was particularly evident in 'Hass' x 'Hass' pollination's. It might be due to a partial self-incompatibility mechanism. Our findings show that apparently a similar mechanism exists in 'Ettinger', 'Fuerte' and 'Nabal' as well. The self-incompatibility reaction occurs, in our opinion, after the fertilization process is completed.

As for the size of the fruitlets, self-pollinated 'Fuerte' and 'Ettinger' fruitlets were smaller than fruitlets of cross-pollination. 'Fuerte' and 'Hass' fruitlets, produced by 'Ettinger' pollen were larger than fruitlets produced by other pollinizers. 'Semil-43' and 'Day' also tended to produce relatively large fruitlets in several cultivars. These findings indicate the existence of metaxenia in young avocado fruitlets.