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POLLEN PRODUCTION IN AVOCADO

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Variation in annual fruit production has been observed to be an inherent characteristic of most avocado varieties in southern California. This erratic bearing behavior has been noted especially in Fuerte, the variety of major importance in the California industry. Nearly all varieties, however, are observed to bloom in relative abundance, but often only a very small percentage of these flowers result in mature fruit and frequent crop failures occur. Hodgson has shown that temperature at time of bloom and fruit set may be the primary factor in crop production. Bringhurst and Lesley and Bringhurst have demonstrated the effectiveness of temperature in relation to anthesis and to the dichogamous behavior of the flowers. The pollen of avocado has been shown to be viable even at relatively low temperatures. The present investigation was undertaken to ascertain whether actual pollen production may be a limiting factor in fruit set.

Observations were made primarily on materials obtained from the avocado variety collection in the University subtropical horticulture orchard, Los Angeles. Collections were also made of materials from commercial orchards in Ventura and San Diego counties. Actual pollen counts were made by teasing the grains from individual anthers into a drop of lactic acid and cotton blue. Observations and counts were made under the dissecting microscope. Only those grains in which the cytoplasm had absorbed the stain were considered viable and counted.

The avocado flower consists essentially of six perianth parts about 5 mm. in length, two whorls of stamens—an outer whorl of six and an inner whorl of three stamens—and a pistil. The six stamens of the outer whorl are identical. The three stamens of the inner whorl have two nectaries each at their base. Each of the stamens in either whorl has four pollen chambers, two large chambers lateral in position and two smaller central chambers with long oval anther valves hinged at the top.

The number of pollen grains produced by an individual stamen within a given flower is approximately constant, regardless of stamen location (Table 1). Single stamen samples, therefore, were taken from individual flowers. Ten to 25 or more flowers constituted the samples from each of the several varieties. While some variation was observed within the samples, the average of 10 or 20 determinations was used as an index for pollen production for the variety. A list of the varieties and their pollen production is given in table 2.

Table 1. Pollen grains in single flower of Fuerte avocado.

Outer stamens	Inner stamens
611	666
609	602
695	516
654	
546	
653	Average: 615.9

Table 2. Average number of pollen grains in avocado flowers.

Variety	Pollen grains
Frey	10,458
Lyon	9,918
Mexicola	8,757
Hass	7,641
Puebla	7,578
Topa Topa	7,254
MacArthur	7,119
Lula	6,903
Blake	6,669
Carlsbad	6,606
Clifton	5,076
Monica	4,797
Fuerte	4,743

There is some correlation between general fruitfulness of varieties and their pollen production. In most of the varieties observed the pollen grains stained well and presumably were viable, with only an occasional grain which appeared abnormal. A few exceptions were noted. One variety, Collinson, not grown commercially in California, apparently does not produce normal pollen grains and fails to dehisce its anthers. This variety is considered to require cross pollination in Florida. Another clone, a low-yielding Weisel Fuerte, was observed to produce about 18% abnormal or functionless pollen grains, hence its viable pollen production is relatively low. A high-yielding clone of Weisel Fuerte growing nearby produces pollen in greater abundance than other trees of the variety Fuerte.

Table 3. Average number of pollen grains in flowers from Fuerte clones at Los Angeles and from different environmental conditions.

Clone	Pollen grains
Fuerte (coastal Los Angeles) standard	4,743
Fuerte (coastal Los Angeles) high yielder	6,705
Fuerte (coastal Los Angeles) low yielder	4,266
Fuerte (inland–Fillmore)	8,101
Fuerte (inland–Fallbrook)	9,747

That the effect of climate may be operative in pollen production is suggested from the data of table 3. It is generally observed that the Fuerte variety is better adapted to certain climatic areas in California such as Fillmore and Fallbrook, inland areas where average yields are higher than in the coastal area, represented by the orchard at Los Angeles. Pollen production in these more favorable areas located inland is considerably higher than along the coast.

The avocado flower has a single ovule which presumably can be fecundated by a single pollen grain. It is evident that in all commercial varieties examined there is an adequate production of pollen grains, hence factors other than pollen numbers probably are responsible for failure of fruit set. While dichogamy may interfere with pollination to a slight extent, empirical observations indicate this phenomenon probably is of very insignificant importance in fruit production in southern California.

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