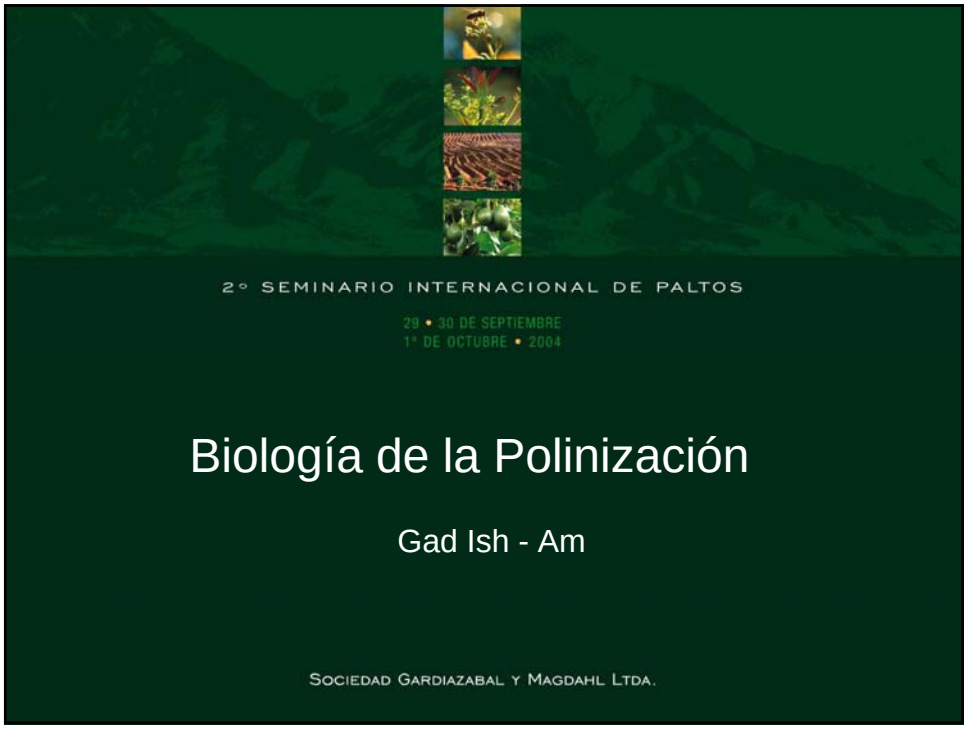
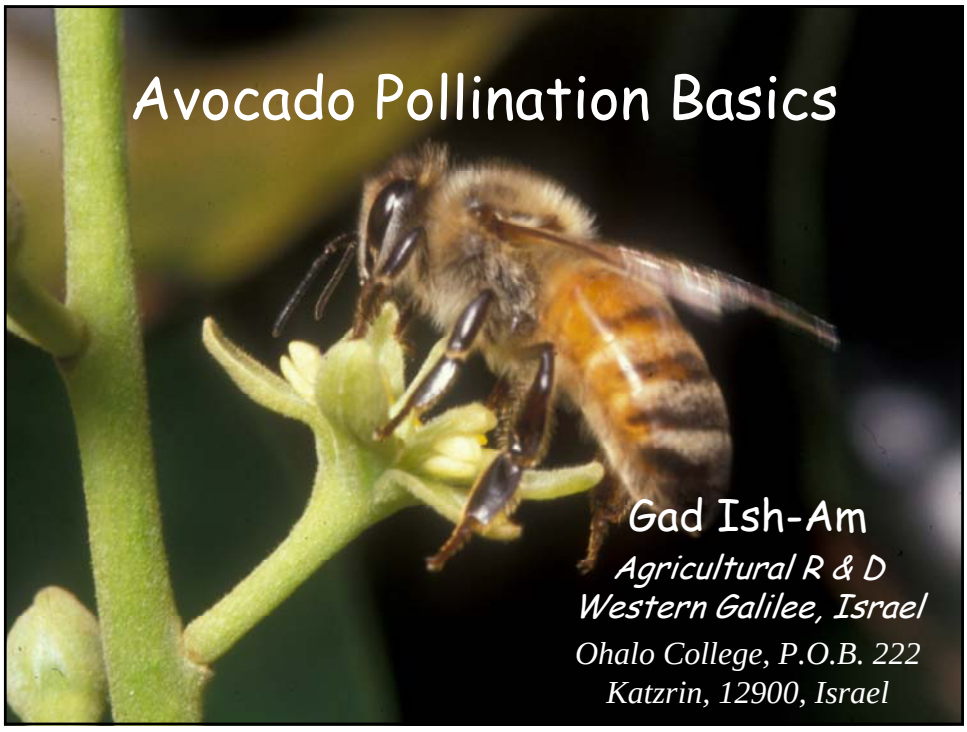

2° SEMINARIO INTERNACIONAL DE PALTOS
29 • 30 DE SEPTIEMBRE
1° DE OCTUBRE • 2004
Biología de la Polinización
Gad Ish - Am
SOCIEDAD GARDIAZABAL Y MAGDAHL LTDA.


Avocado Pollination Basics
Gad Ish-Am
Agricultural R & D
Western Galilee, Israel
Ohalo College, P.O.B. 222
Katzrin, 12900, Israel

To maximize yield one needs:

Effective pollination

↓

Efficient pollinator
(many honey bees)

Sufficient
cross pollination

↓

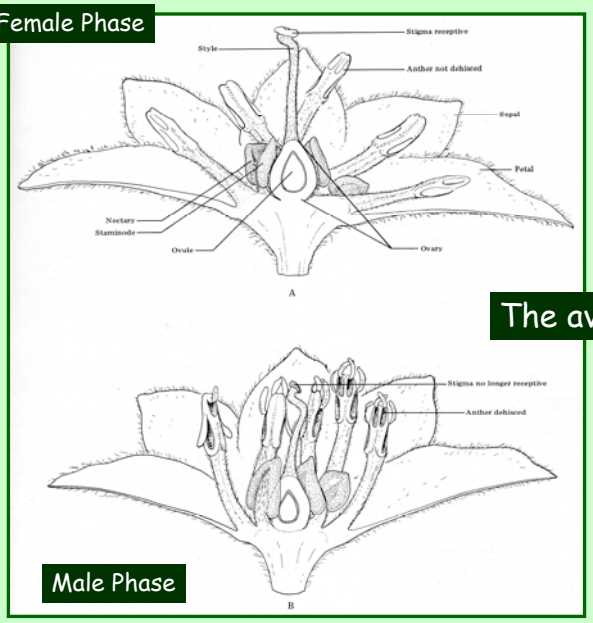
Pollinizers in
close proximity

Avocado Flower Phases

Female Phase Flower
'Reed'

Male Phase Flower
'Fuerte'

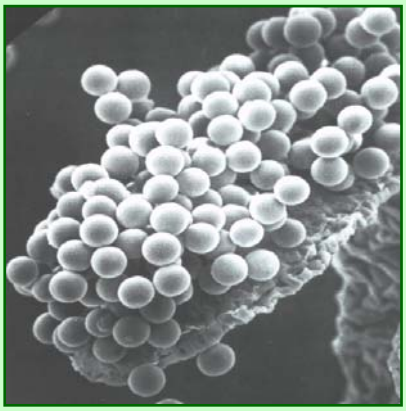
Female Phase



The avocado flower

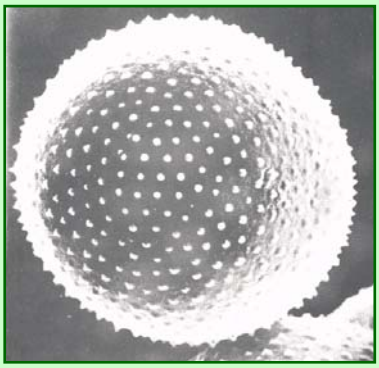
Male Phase

The avocado pollen



Ettinger pollen grains attached
To an open valve of the anther

Source: Ish-Am, 1994. PhD Thesis



Fuerte pollen grain

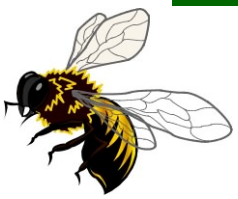
Source: Gazit & Degani, 2002.

Pollination Terms:

Pollination – the transfer of pollen from the anther to the stigma.

- *Cross pollination* – the pollen deposited on the stigma is from another cultivar.
- *Close pollination* – the pollen deposited on the stigma is from another flower of the same tree or cultivar.
- *Self pollination* – the pollen deposited on the stigma is from the same flower.

Pollination Terms:



Pollinator: The agent which transfers pollen from the male to the female floral organ.

Pollinated Tree: A cultivar that receives the pollen *(i.e. Hass).*

Pollinizer: A cultivar that donates pollen to another cultivar.
Common Hass pollinizers: Bacon, Zutano, Ettinger, Edranol, Walter Hole.

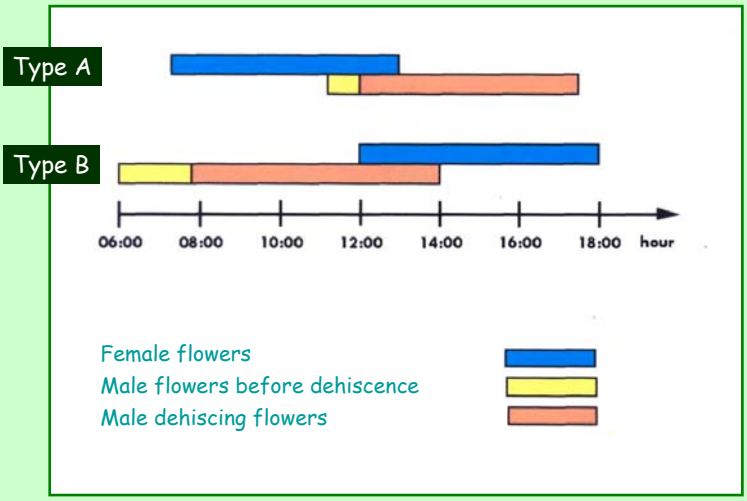
Pollination Terms:

Fertilization – the fusion of the male gamete with the female gamete forming the zygote.

Effective Pollination – pollination which leads to fertilization.

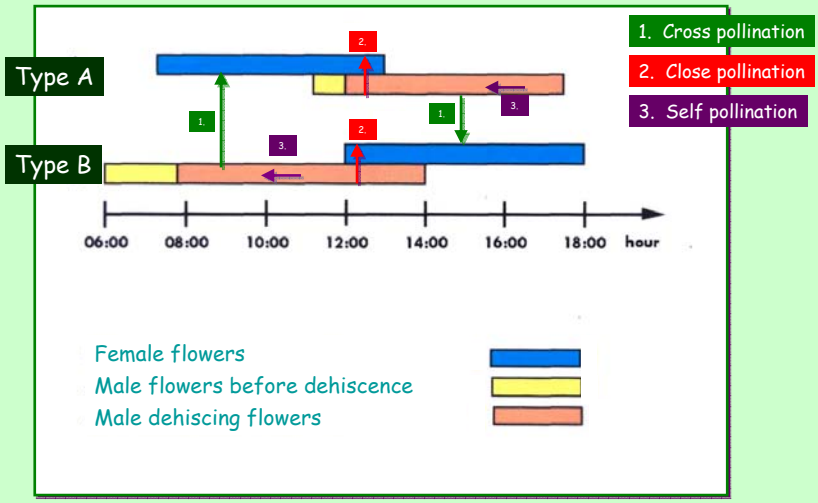
Non effective pollination – pollination which does NOT lead to fertilization.

Avocado Flowering Sequence

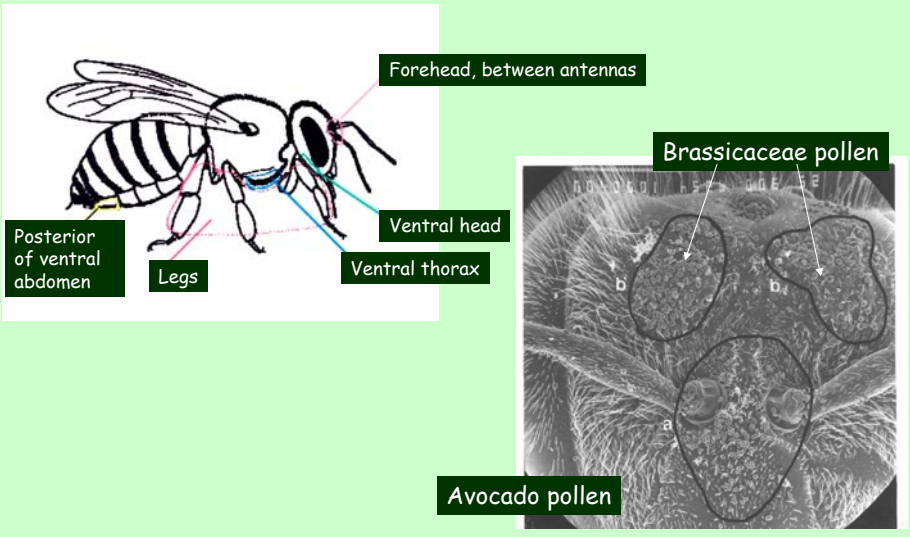


Within the tree overlapping of 'Hass' female and male flowers

Avocado flower pollination routes



Regions of avocado pollen transfer on the honeybee body

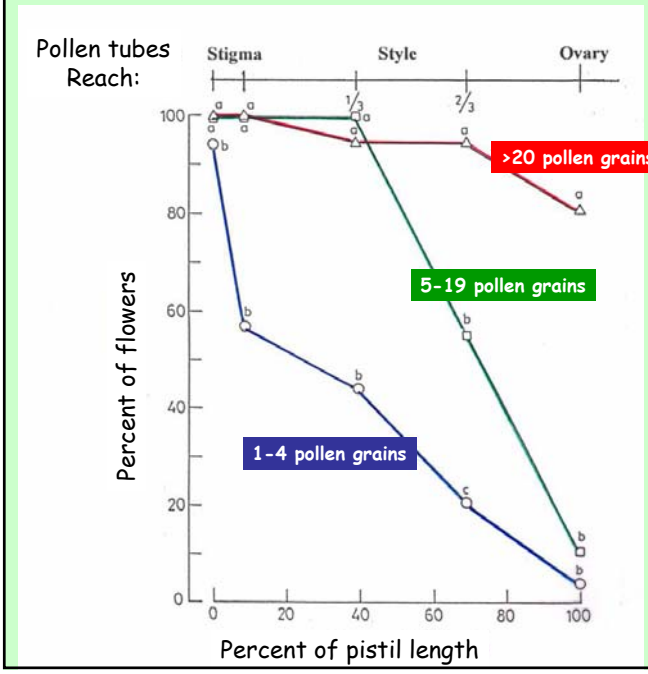


Honey bees transferring avocado pollen between male and female flowers

Why does the avocado tree produce so many flowers?

- Attraction: the whole tree acts like a giant inflorescence with many small flowers.
- Small fertilization percent: thus most flowers do not set fruit.
- Competition: between fruits and growth, as well as among the fruits, which leads to high rate of primary-fruit abscission.

Avocado Pollen Germination Rate

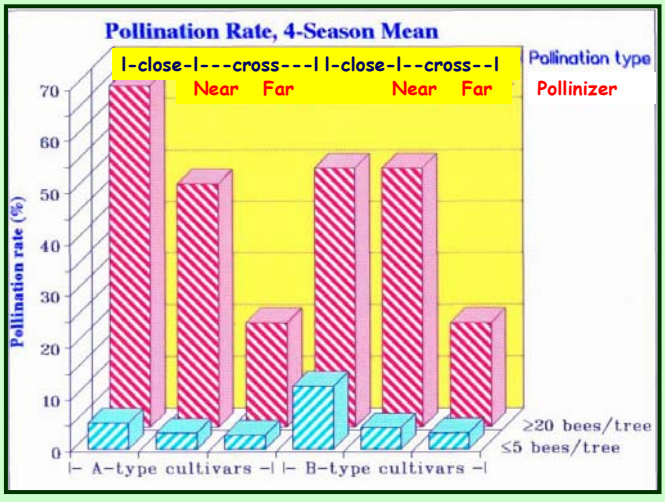


Hand pollinated 'Hass' stigmas by 'Ettinger' pollen.
Four hrs of germination.

Shoval, 1987

Effect of competition between and cooperation among the pollen grains

The need for honeybees: pollination rate



Source: Ish-Am, 1994. PhD Thesis

Arguments:

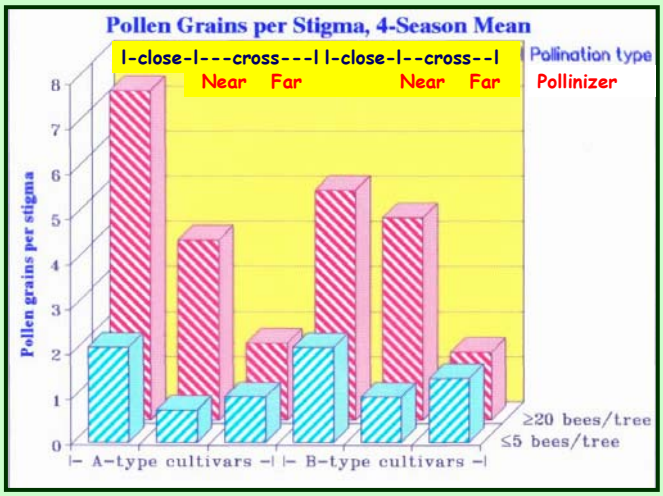
a. Number of bees per tree: more than 20 are demanded.

b. Pollination type: close-pollination is higher than cross-pollination, with a far pollinizer.

c. Pollinizer distance: near pollinizer induces higher cross-pollination.

d. Cultivar flowering-type: "A" types get higher close-pollination.

The need for honeybees: number of pollen grains per stigma



Source: Ish-Am, 1994. PhD Thesis

Arguments:

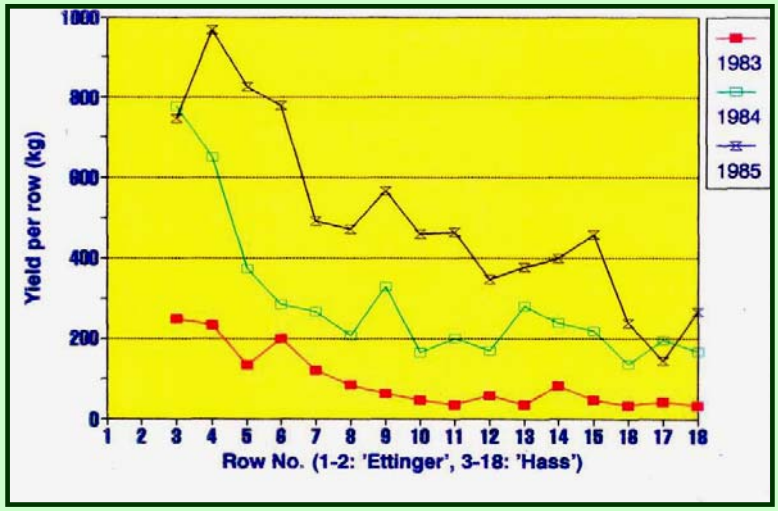
a. Number of bees per tree: more than 20 are demanded.

b. Pollination type: close-pollination develops more pollen grains.

c. Pollinizer distance: near pollinizer causes more cross-pollen grains.

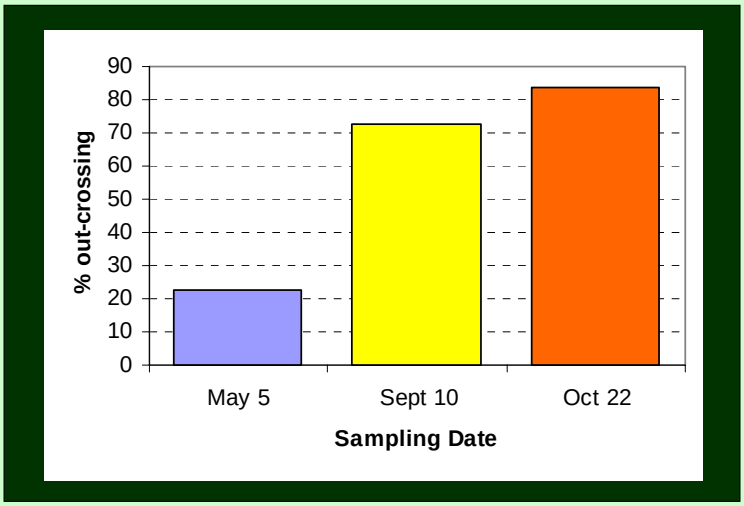
d. Cultivar flowering-type: "A" types gets more close-pollen grains.

Hass yields decrease significantly with increasing distance from 'Ettinger'



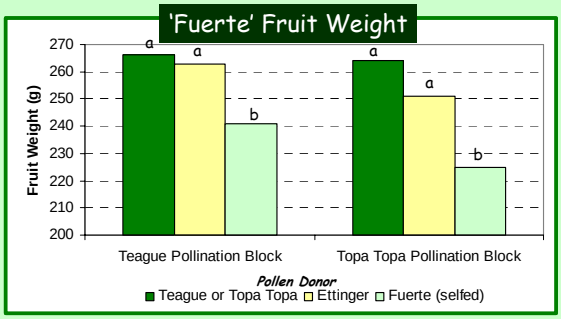
Source: Guil et al. 1986. Alon Hanotea 40:443-455

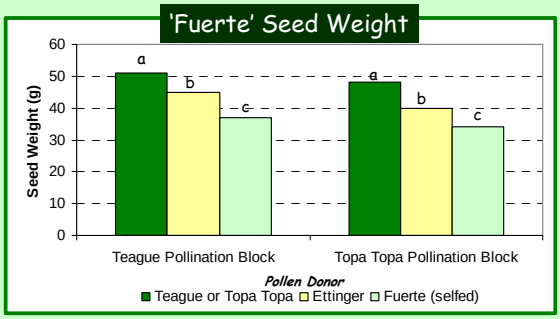
Survival of cross vs. self progenies



Percent of crossed 'Hass' fruits by both 'Ettinger' or 'Fuerte' according to time after fruit set.

Source: *Degani, Goldring and Gazit. 1989. J. Amer. Soc. Hort. Sci. 114:106-111*
Via www.avocadosource.com





Pollen Donor Effect (metaxenia)

The pollen donor cultivar impacts fruit weight and seed size.

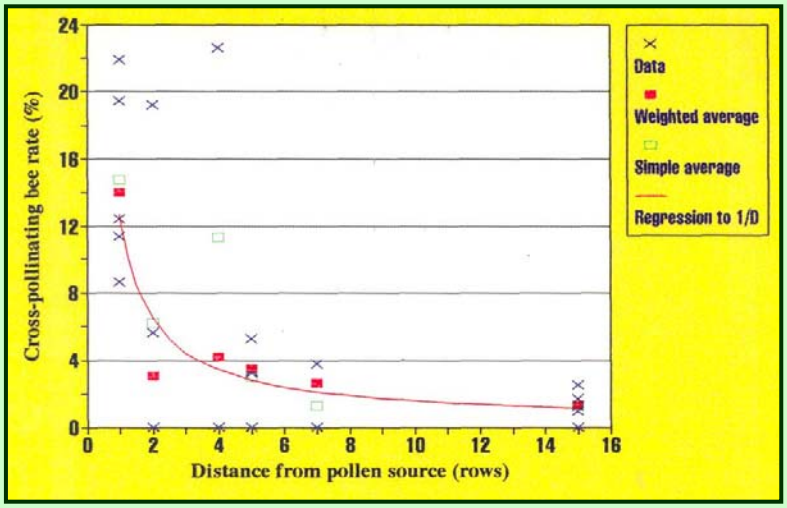
Data from Israel for 'Fuerte' fruit with 'Teague', 'Ettinger' or 'Topa Topa' as pollen donors.

Source: Degani et al. 1990. HortScience 25(4):471-473 via www.avocadosource.com

PROXIMITY

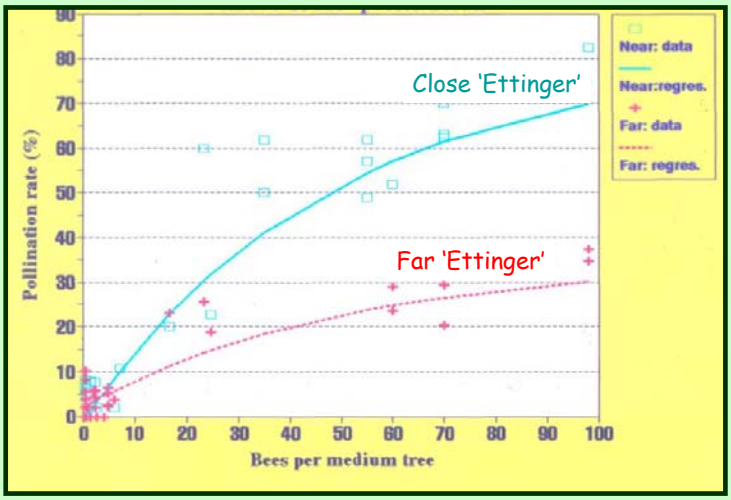
Percentage of cross-pollen carrying honeybees on 'Hass'

as a function of distance from the pollinizer



Source: Ish-Am and Eisikowitch, 1996.

'Hass' cross pollination rate as a function of bee density and distance from the pollinizer

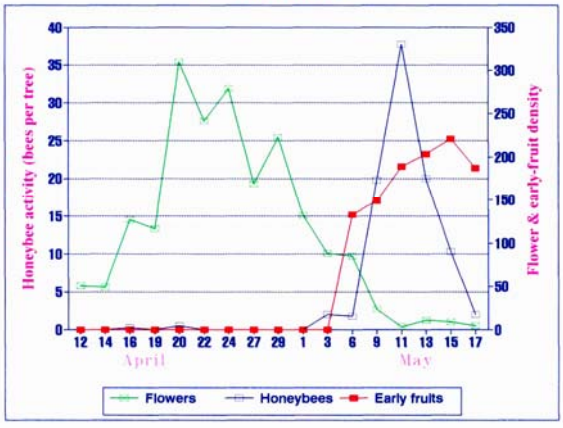


Source: Ish-Am, 1994. PhD Thesis

Multiple pollinizers

ATTRACTIVITY

'Hass' flowering, honeybee activity and fruit set - Israel, spring 1992

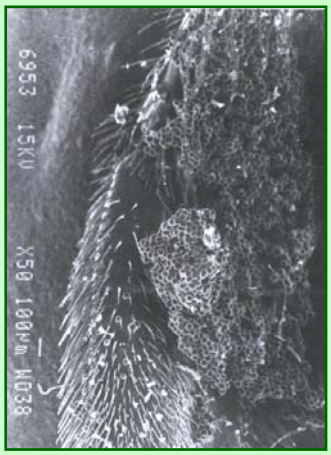


Source: Ish-Am, 1994. PhD Thesis

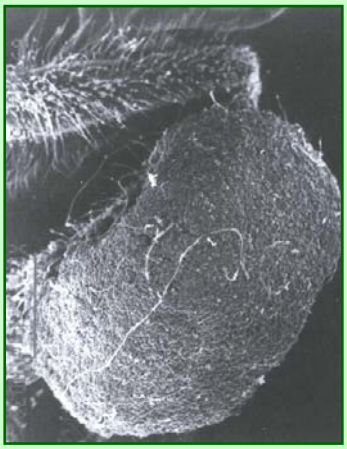
No correlation found between avocado flowering intensity and honeybee activity in the presence of competing bloom.

High correlation found between fruit set and honeybee activity.

Avocado pollen is not organized well in the honeybee's pollen-load



Pollen load on hind leg of a honeybee containing Ettinger pollen.



Pollen load on hind leg of a honeybee containing White Mustard pollen.

Source: Ish-Am, 1994. PhD Thesis

Close-up of pollen in the honeybee's pollen load

Close-up of 'Ettinger' pollen in the pollen load of a honeybee

Close-up of White Mustard pollen in the pollen load of a honeybee

Source: Ish-Am, 1994. PhD Thesis

How many honeybees per tree are necessary?

How many honeybee hives per hectare are needed?

Monitoring honeybee-hive density

Bees per tree	Self-fruit set	Cross-fruit set	Adding hives
0	none	none	necessary
1 - 4	none	none	necessary
5 - 9	few	none	necessary
10 - 25	many	few on the 1st row	recommended
26 - 55	many	on 1st to 2nd rows	may be helpful
more than 55	many	up to the 4st row	not needed

Source: Ish-Am, 1994. PhD Thesis

To maximize yield one needs:

Effective pollination

↓

Efficient pollinator
(many honey bees)

Sufficient
cross pollination

↓

Pollinizers in
close proximity

For more information visit

www.avocadosource.com