Honey bee behavior and how they forage in avocado

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The pioneers in avocado pollination research in Israel

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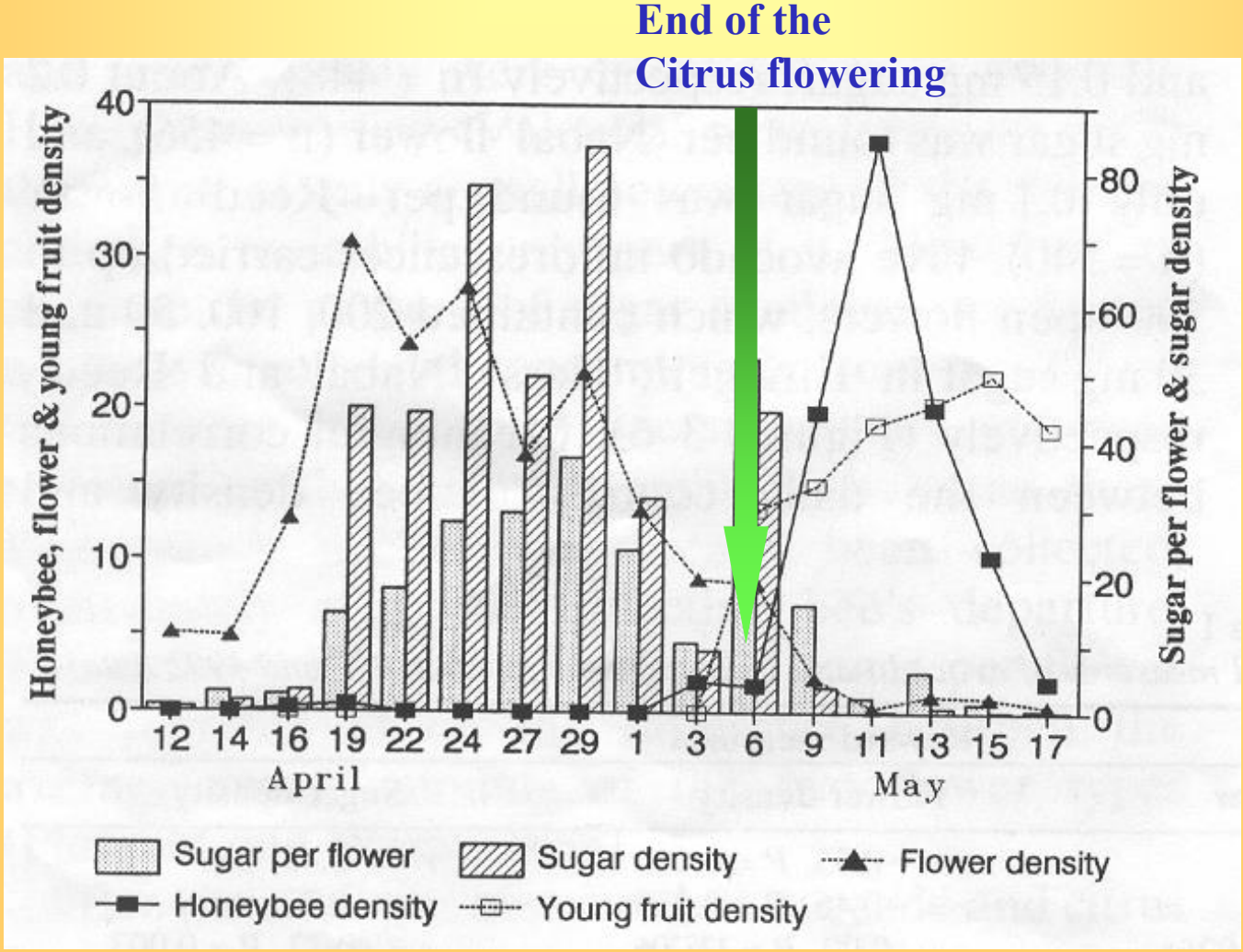
Dr. Chemda Degani

Prof. Dan Eiskowich

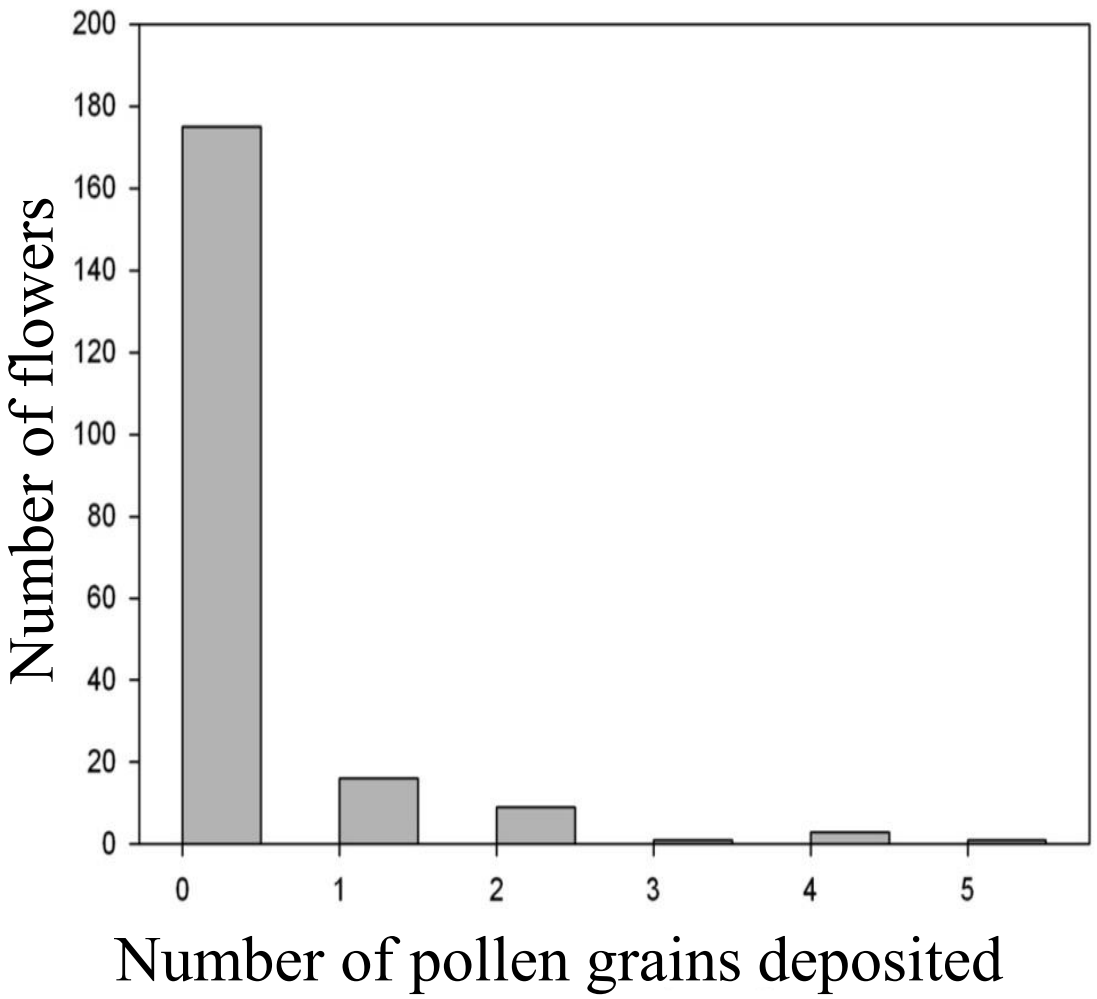
- Honeybees are the main pollinators of avocado.
- Unfortunately, the avocado bloom is not very attractive to honeybees and hence they tend to abandon its bloom in favor of competing flora.

Seasonal course of rewards measures, bee and young fruit density of 'Hass' avocado



Ish-Am & Eisikowitch (1998) J. Hort. Sci. Biotech. 73: 195-204

Pollen grains per stigma Australia and New Zealand, 2011



Pattemore et al., 2014

Israel (Western Galilee, 2018)

Only 7 out of 1,200 flowers (0.58%) examined, were pollinated. Out of the 7 pollinated flowers, only on 2, the number of pollen grains was > 5.

Avocado flowers are less attractive for honey bees than competing bloom

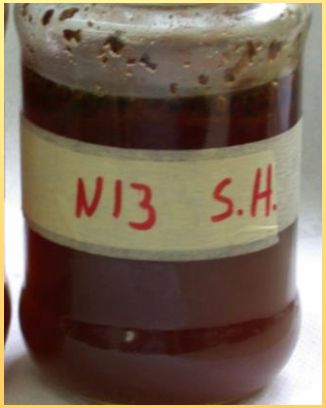
Citrus flowers

Avocado flowers

Why ?

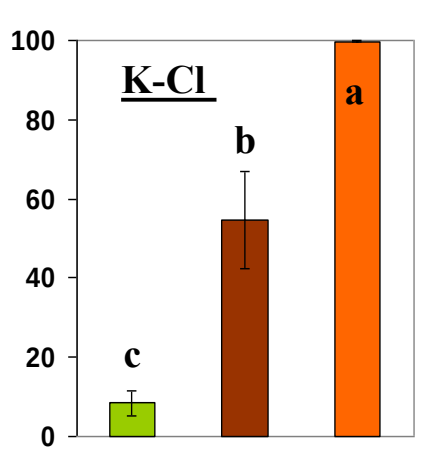
Avocado nectar and honey are rich with minerals (mg/kg)

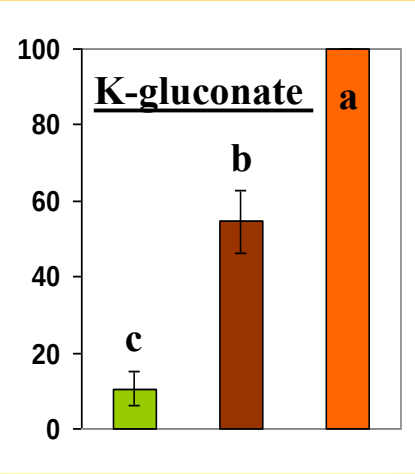
Mineral	Avocado nectar	Citrus nectar	Avocado honey	Citrus honey
K	3946	185	3768	325
P	511	19	652	47
Mg	188	<5	205	19
S	170	<5	188	28

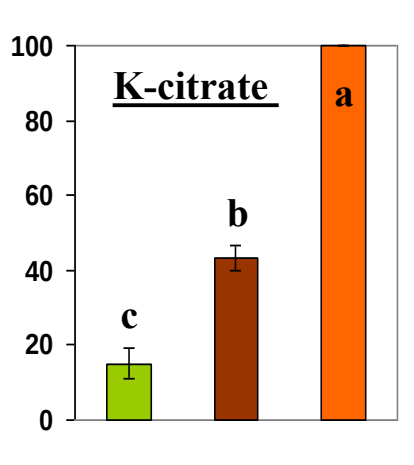


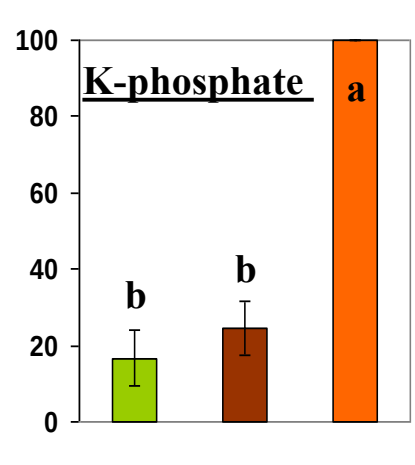
Afik et al., (2006) J. Chem. Ecol. 32: 1949-1963

Potassium and phosphate repel honey bees (relative consumption rate)









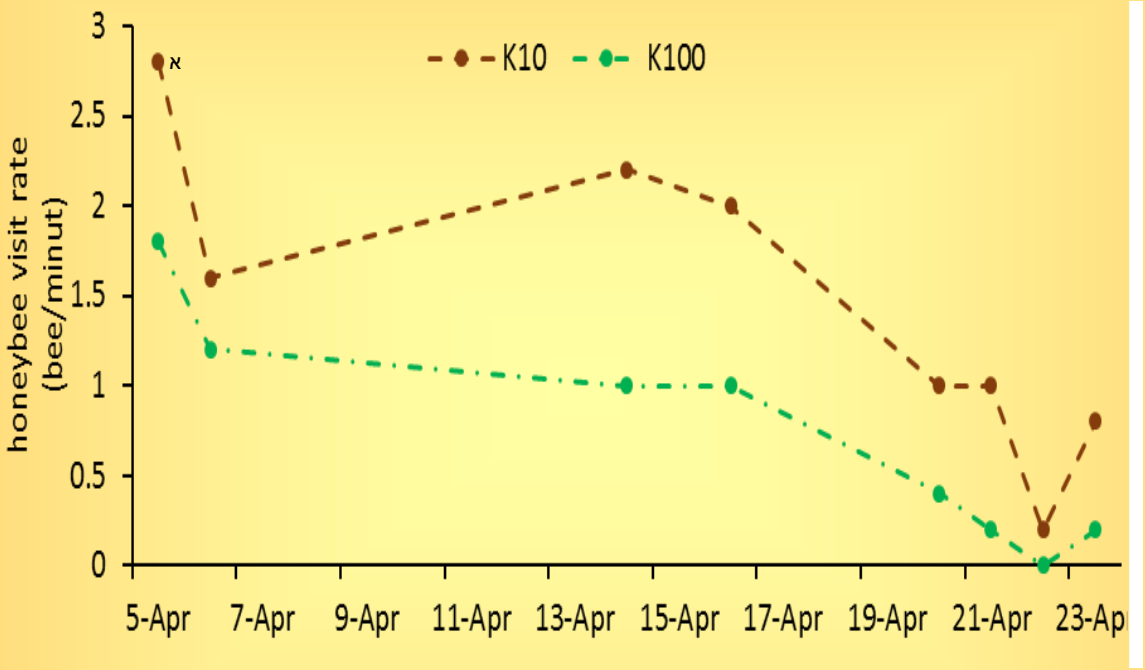
Avocado honey

Citrus honey & potassium

Citrus honey

Afik et al., (2006) J. Chem. Ecol. 32: 1949-1963

The effect of potassium level in irrigation water (10 vs. 100 pp”m) on bee activity (Gilat, 2020).



High level of potassium is a major cause for the low attractiveness of honeybee to avocado nectar

Can we select honeybee's strain with better preference to avocado flowering ?

NWC
New World Carniolan

Markers

Avocado – nectar collectors

Nectar collectors

Pollen collectors

Comparison between avocado honey and non-avocado honey

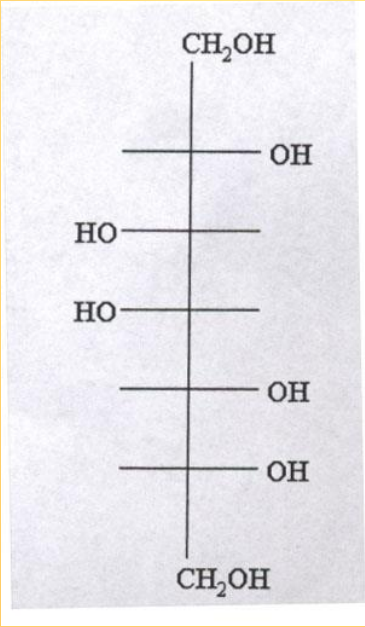
Non-avocado honey

Avocado honey

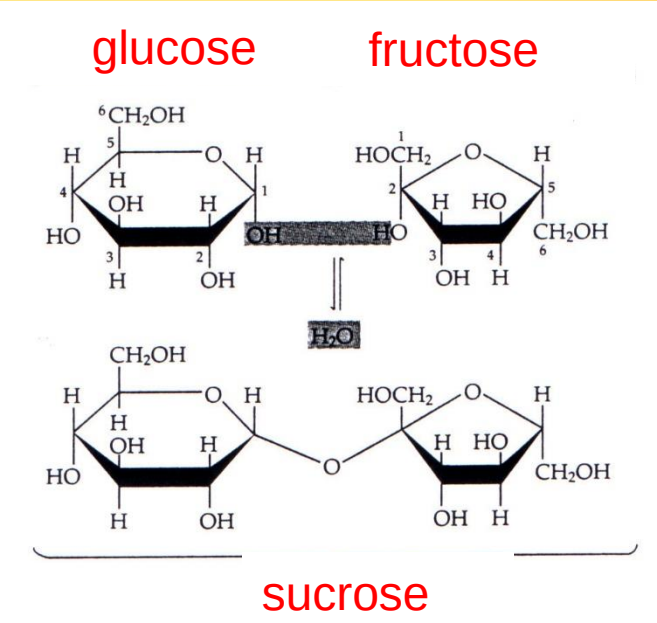
Dag et al., 2006. *Int. J. Food Sci. Tech*. 41: 387-394.

Specific markers for avocado honey / nectar

Level of perseitol:



perseitol



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HPLC Analyses

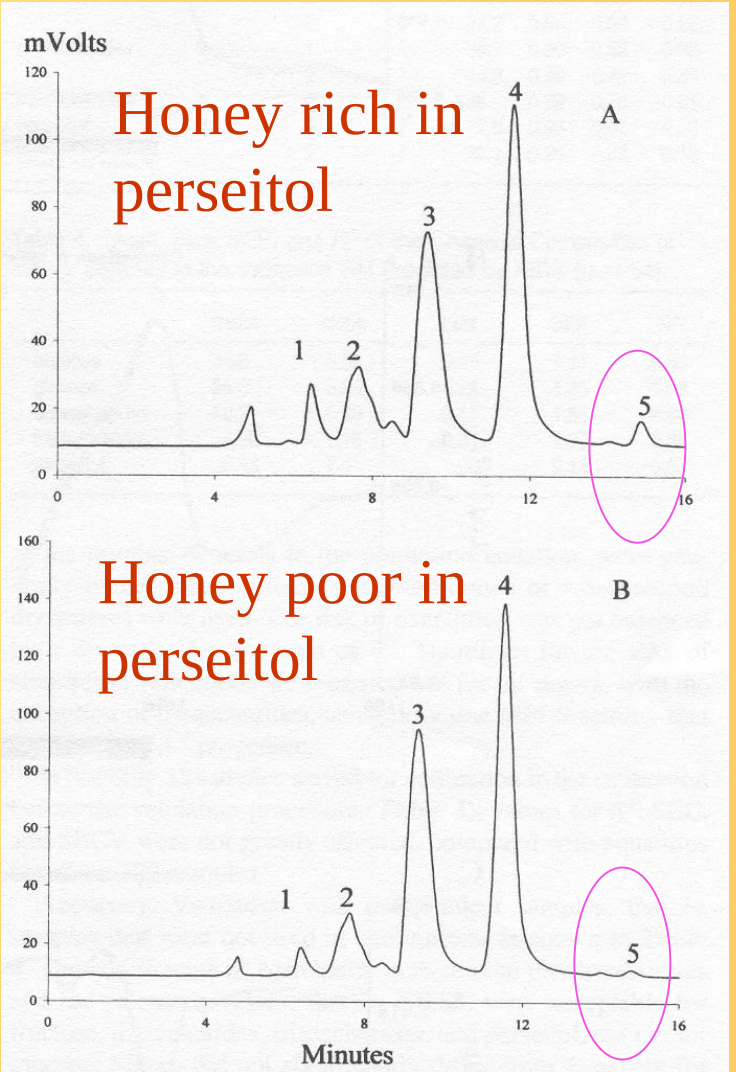


Figure 1. HPLC chromatograms of honey rich (A) or poor (B) in perseitol. Peaks: 1, trisaccharides; 2, disaccharides; 3, glucose; 4, fructose; 5, perseitol. The trisaccharide fraction (1) coeluted with the raffinose standard, and the disaccharide fraction (2) coeluted with both sucrose and maltose.

Devash et al., 2002. *J. Agric. Food Chem*. 50: 5283-5287.

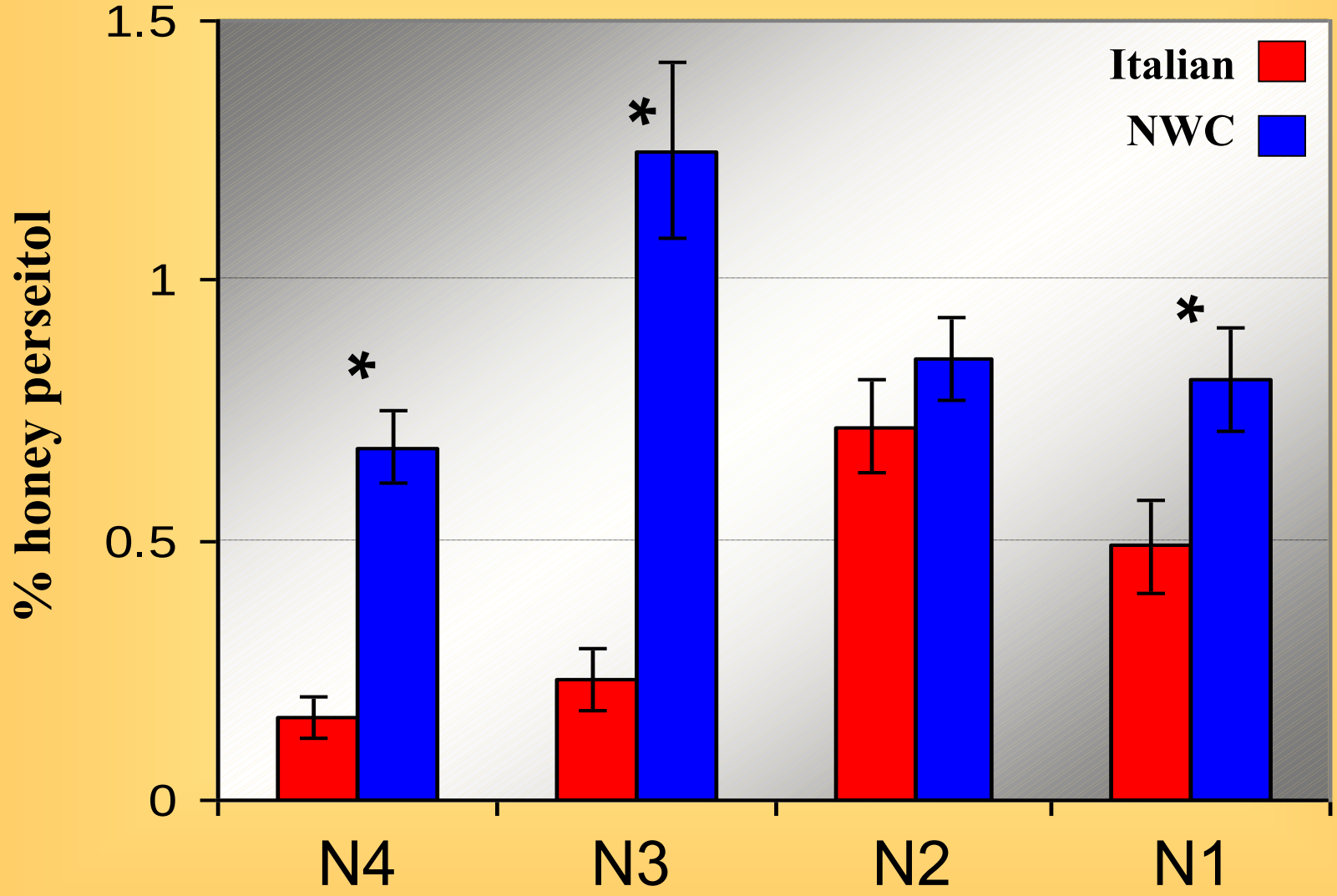
Experimental sites

Compared bee races:

Italian (It)

New World Carniolian (NWC)

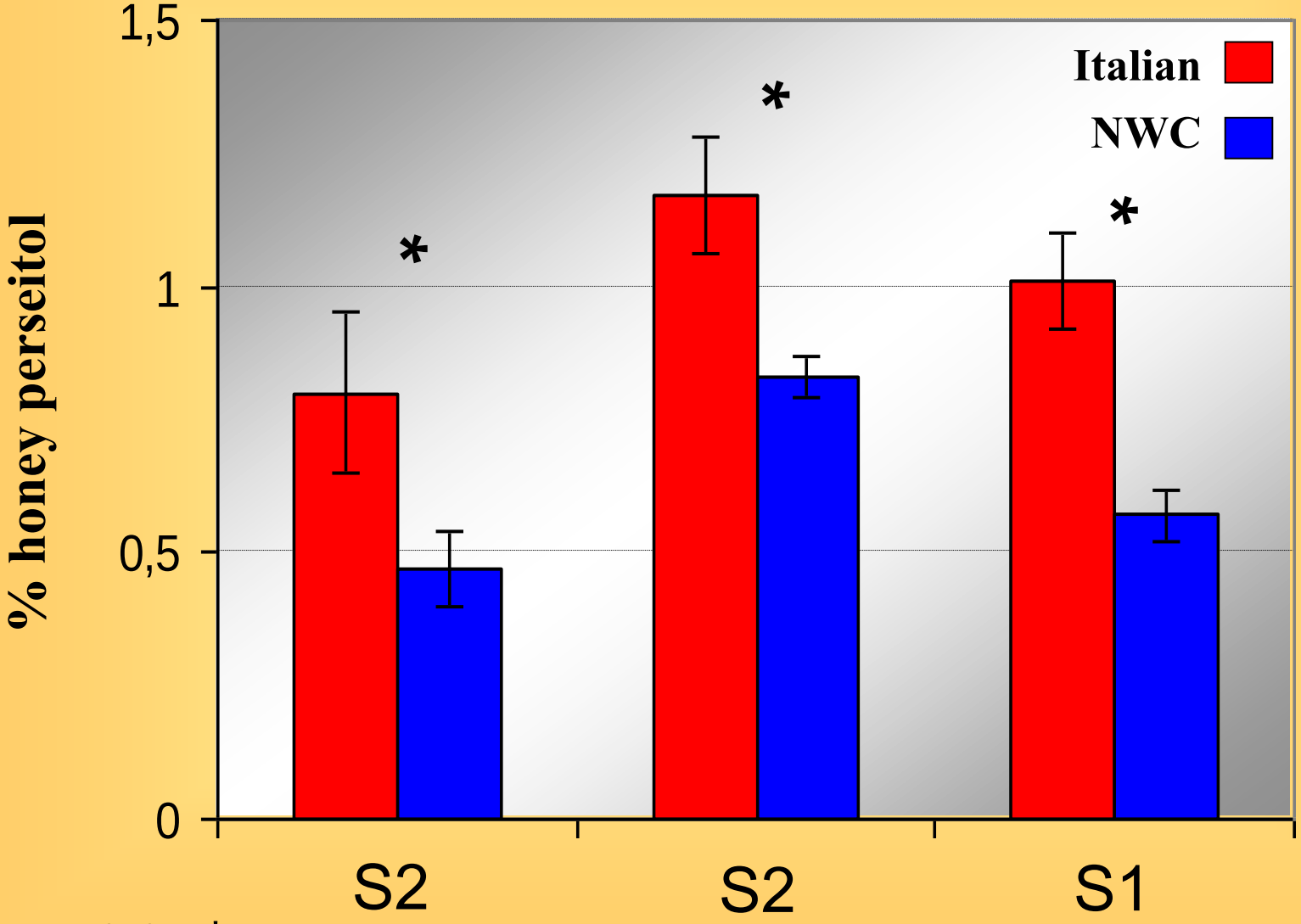
Differences between races in northern sites



P < 0.05 *

Dag et al., (2003) Apidologie. 34: 299-309

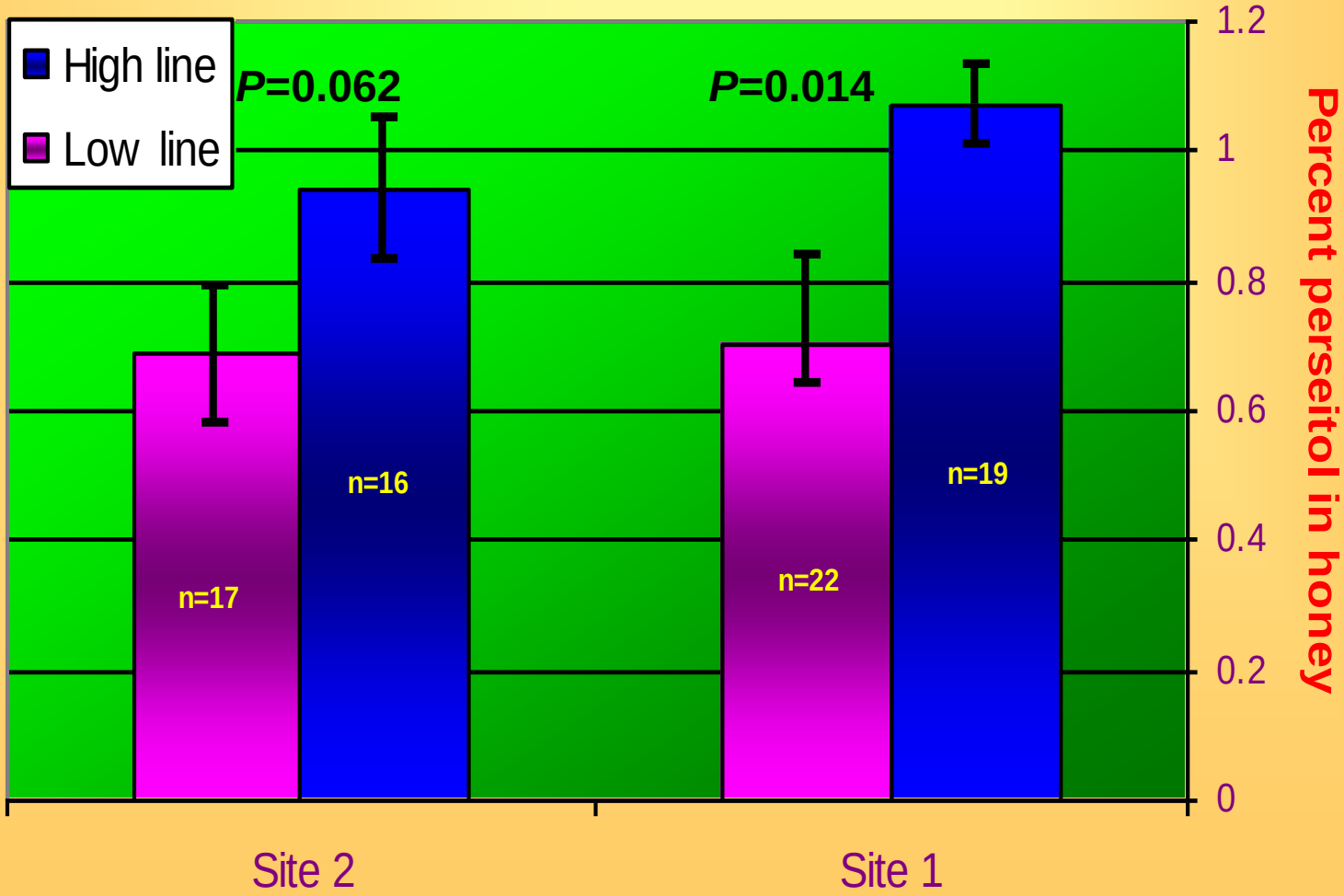
Differences between races in southern sites



P < 0.05 *

Afik et al., (2007) Entomologia generalis 32: 135-153

The effect of genetic background on the honey bee tendency to collect nectar from avocado flowers.

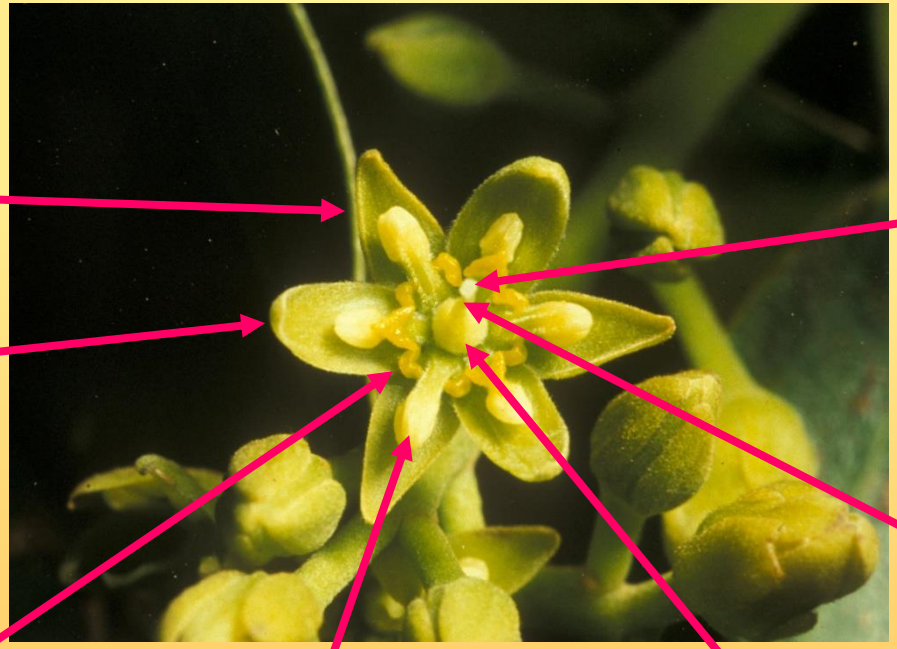


Afik et al., 2010. J. Econ. Entomol. 103: 228-233.

There is a genetic X environmental background for honeybee preference to avocado flowering

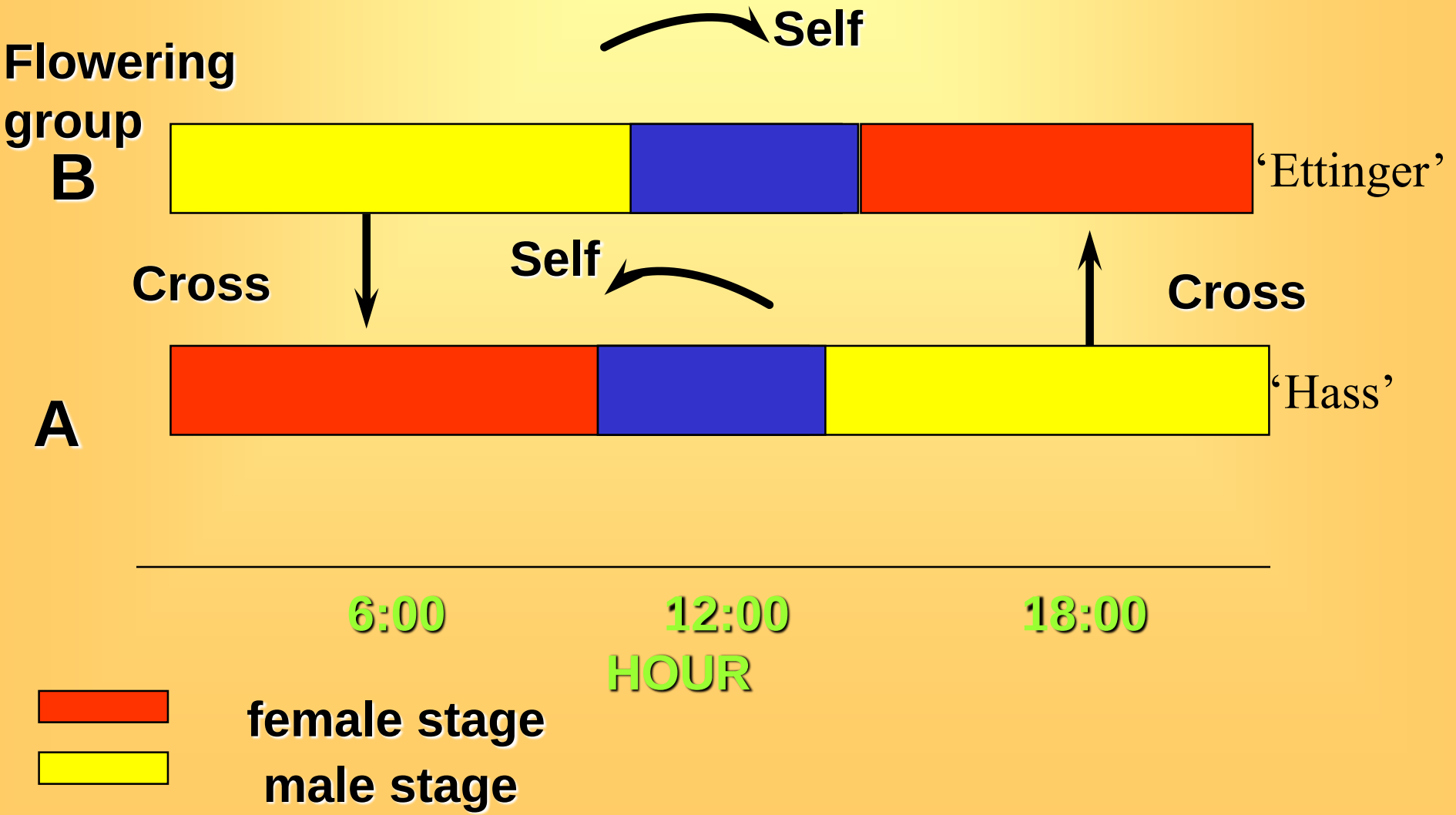
Pollenizers

Flower at first opening is female



E. Shuv

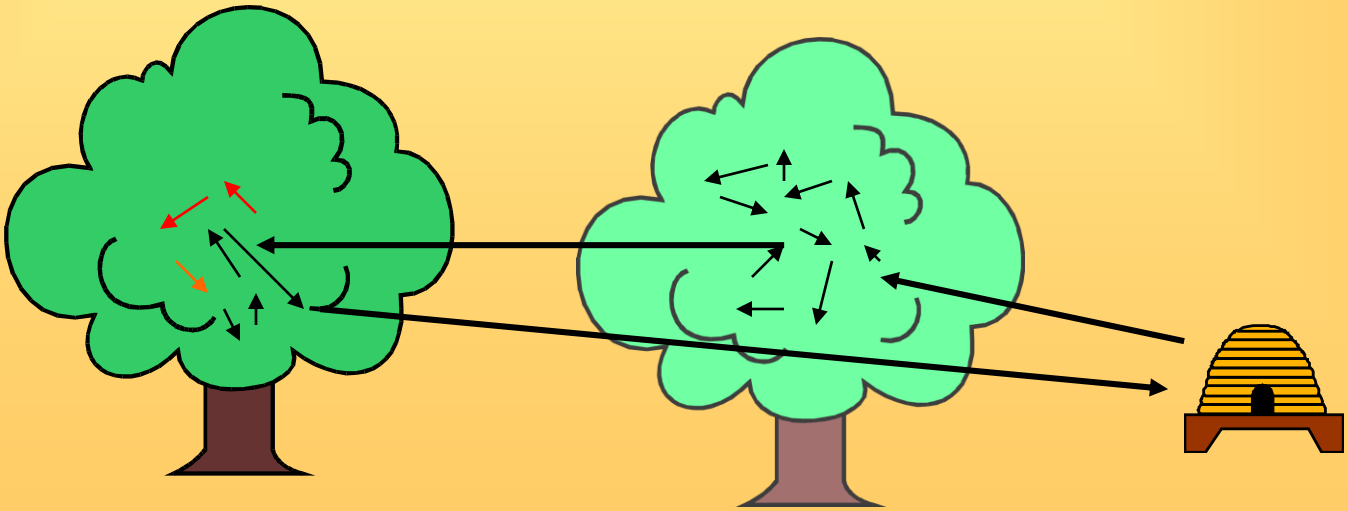
Avocado pollination



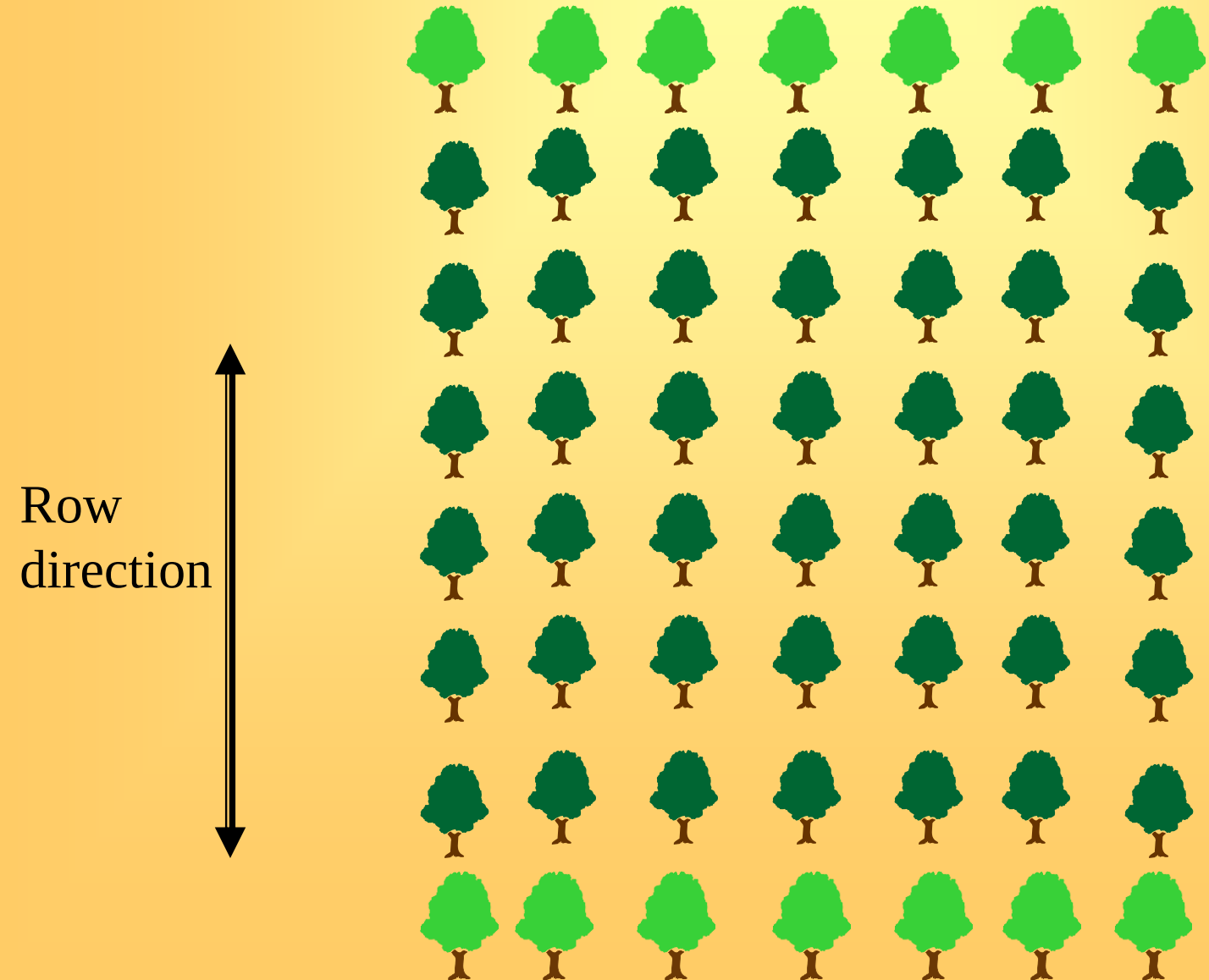
Cross pollination
Bee movement

♀ ♂

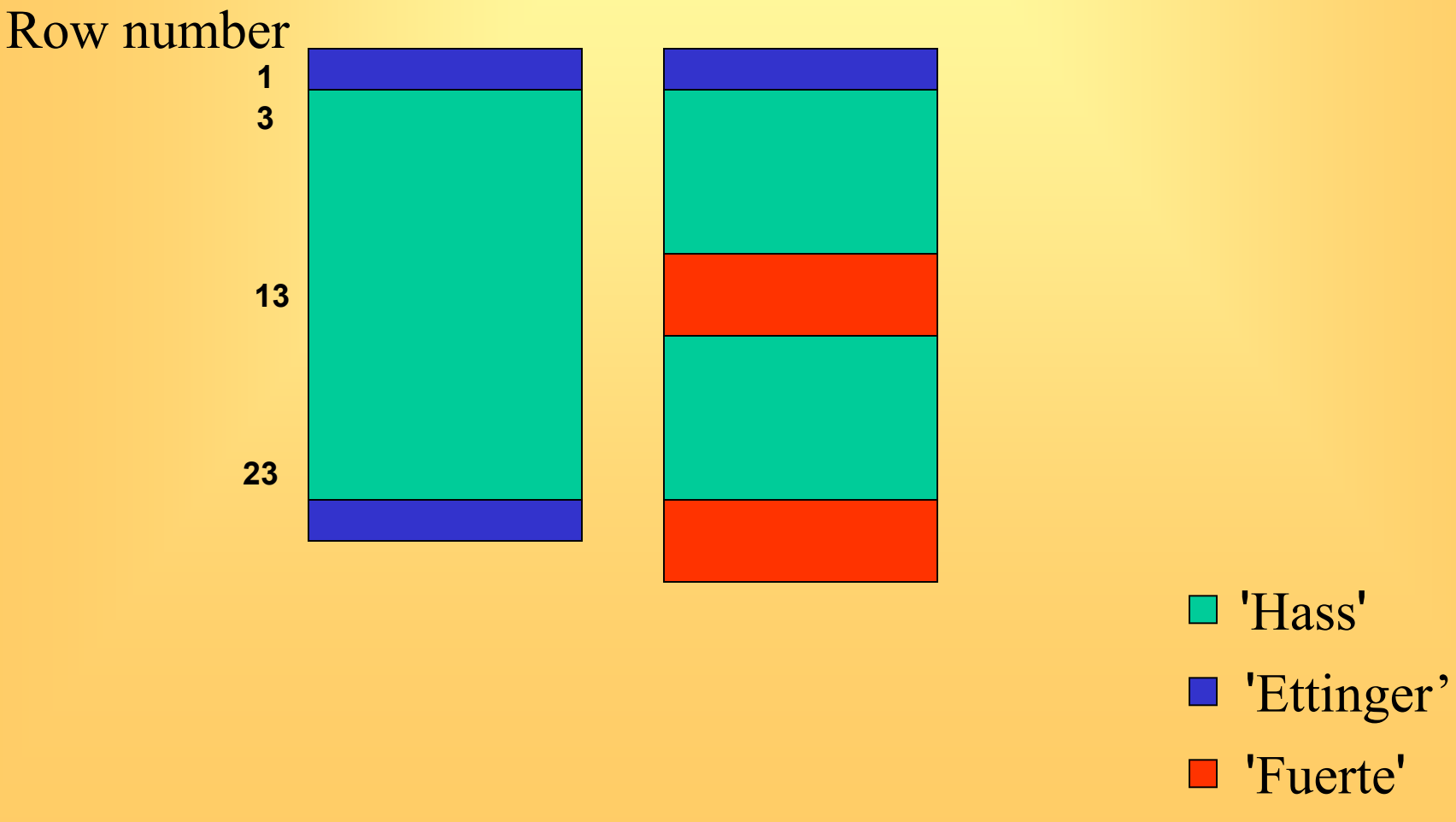
‘Hass’ **Pollenizer**



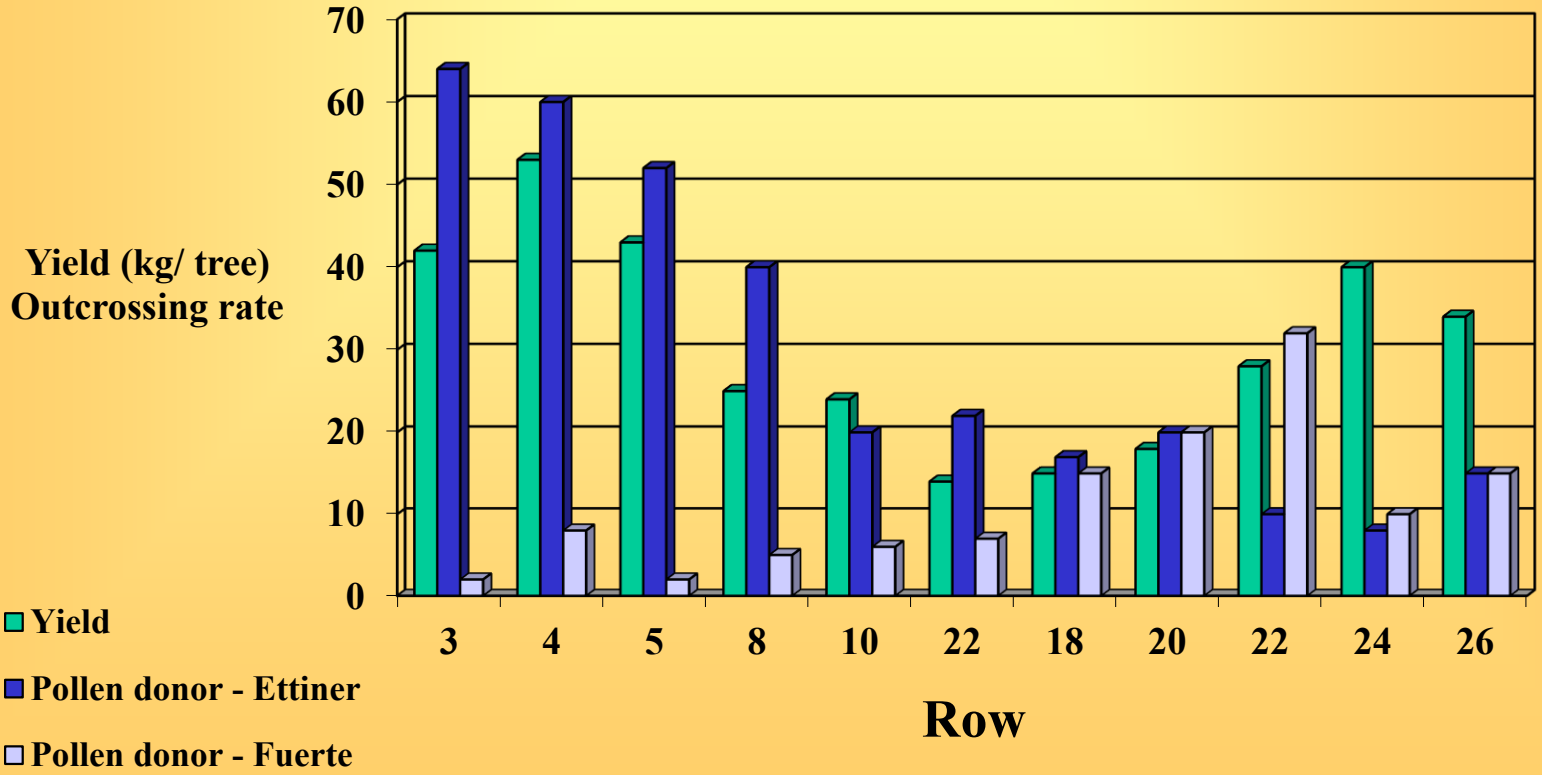
Combining pollenizers; end of the rows



The effect of pollinizer on avocado productivity, Givat Brener, 1984

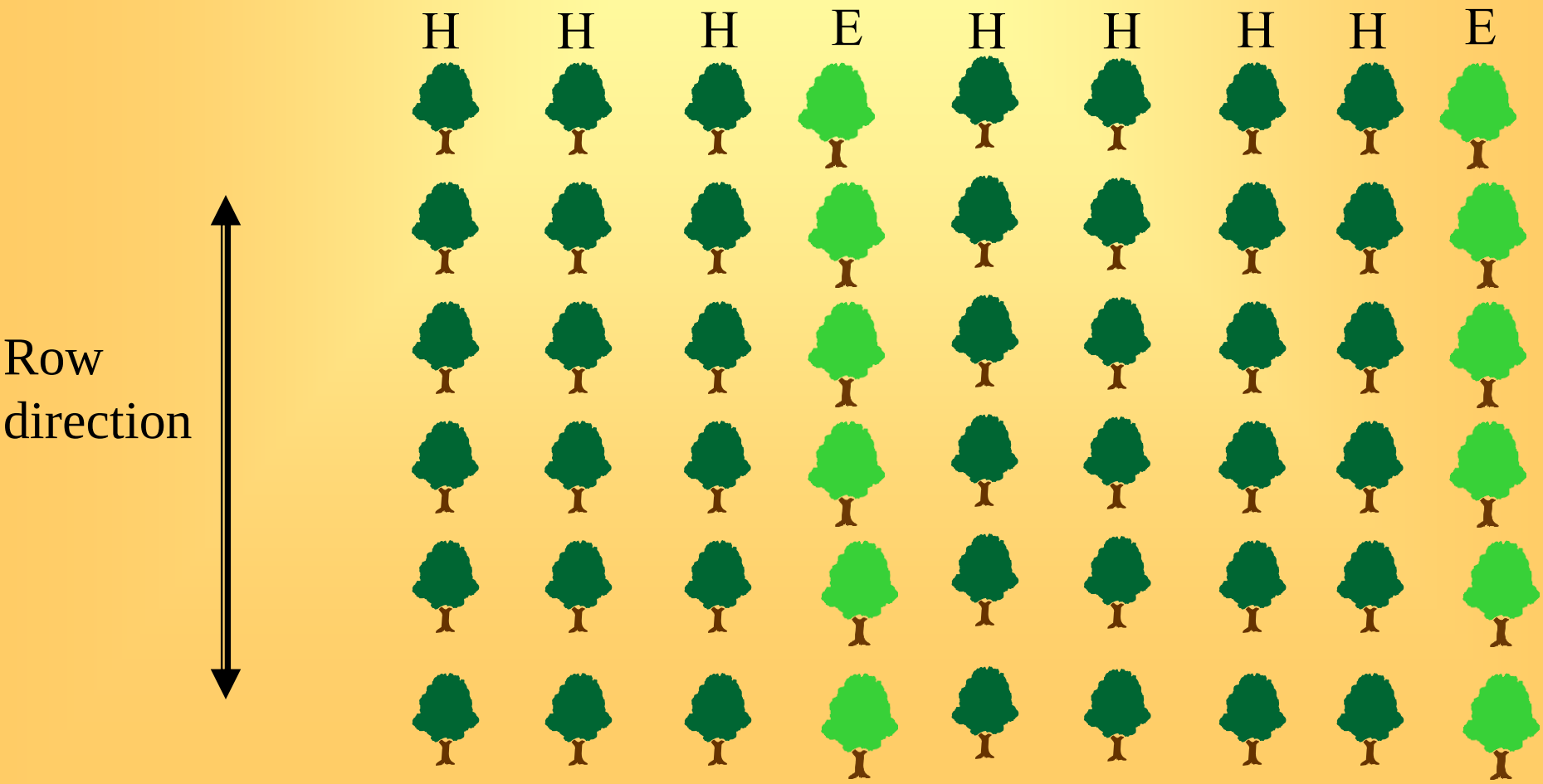


The effect of pollinizer proximity on yield and outcrossing rate, Givat Brener 1984

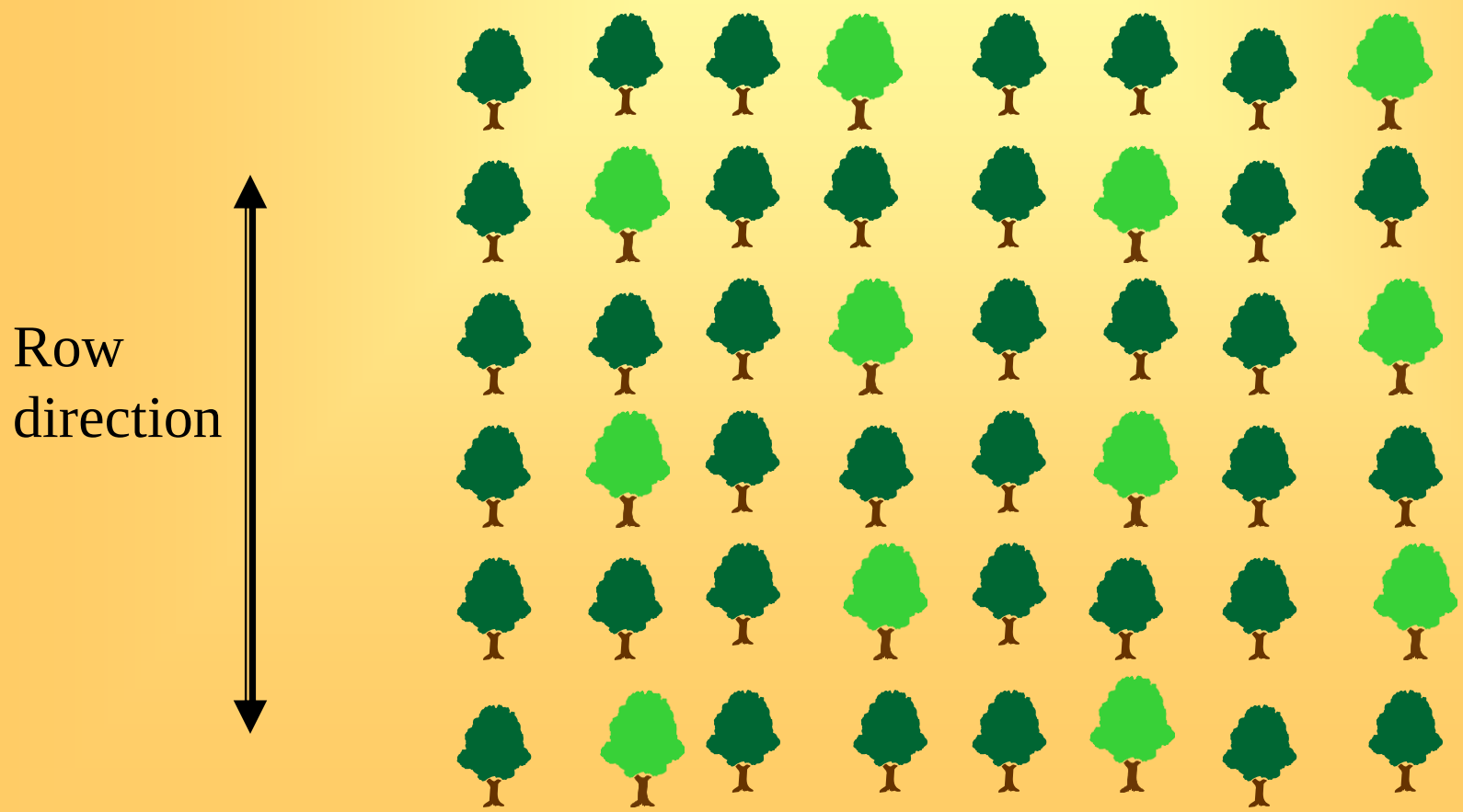


Degani et al., 1989

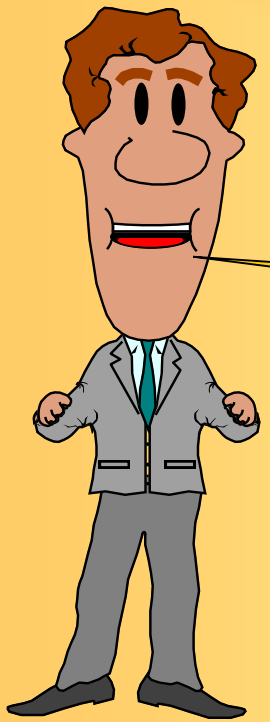
Combining pollenizers, full rows 1:4



Combining pollinizers:1:9



Acknowledgments



- BARD: The United States - Israel Binational Agricultural Research and Development Fund
- The Ministry of Agriculture
- The Israeli Fruit Council
- Sharon Shafir, Ohad Afik, Mary Lu Arpaia, Reuben Hofshi, Ran Erel

Thank you for your attention