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Pollination: The answer is blowing in the wind

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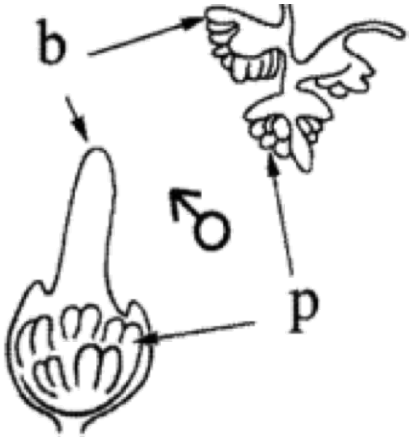
What determines yield?

1. The number of female flowers.
   - Number of shoots (or buds).
   - Previous season and early current season "stress".
2. The number of those flowers that mature into a fruit.
   - Physiological fruit drops (pollination and "stress")
   - Physical fruit losses (wind, hail, nut-feeding insects, other animals, etc.)

What's going on with pollination?

Staminate (Male) Flowers



Fulbright, 2003

Mature flower with anthers dehiscing.

Wetzstein and Sparks 1986

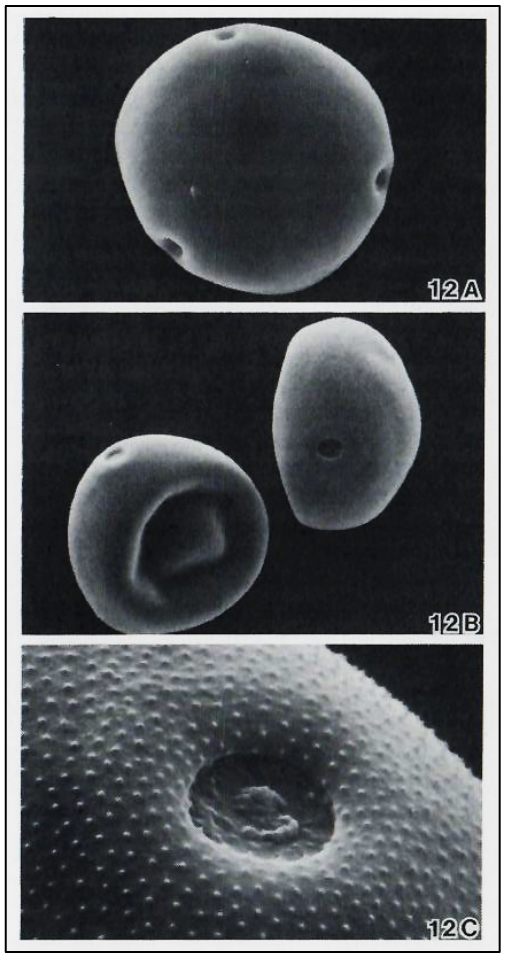
Staminate (Male) Flowers

- High humidity delays pollen release.
  - Temperature during winter and spring determine the time of staminate flower maturity.
  - Temperature at bloom is of "secondary importance" in timing of pollen shed.

(Yates and Sparks, 1993; Woodroof, 1930)

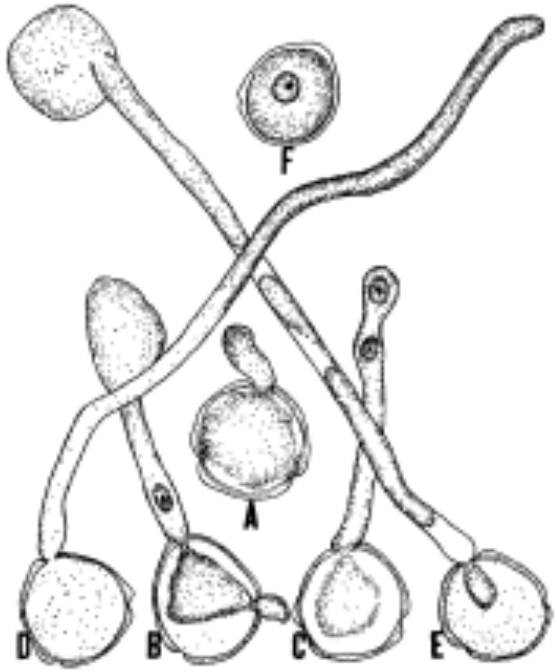
Pollen

Scanning electron micrographs of pecan pollen.



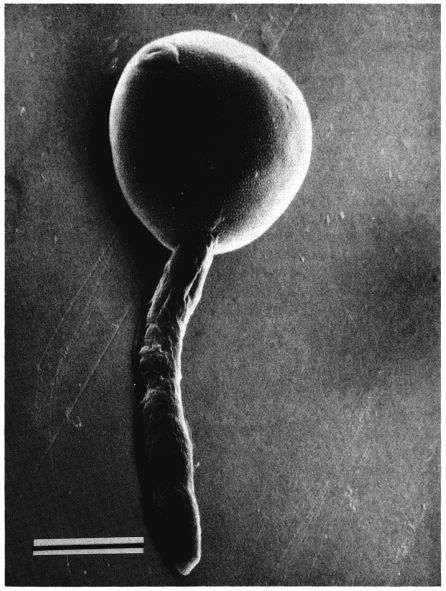
Wetzstein and Sparks 1986

Development of pollen tubes.



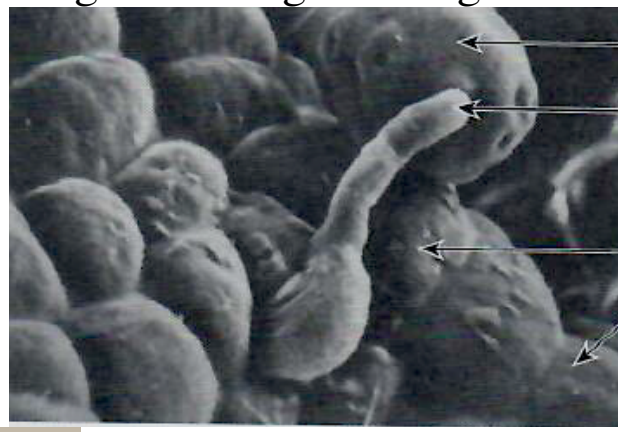
Woodroof, 1930

Pecan pollen germinating in vitro.



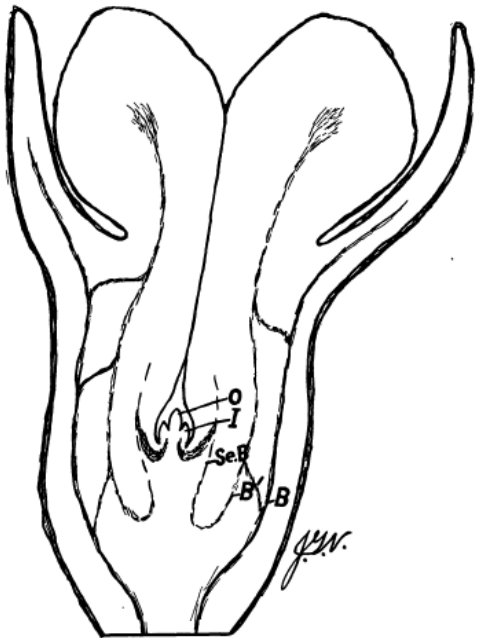
Yates and Sparks 1993

Walnut pollen germinating on a stigma.



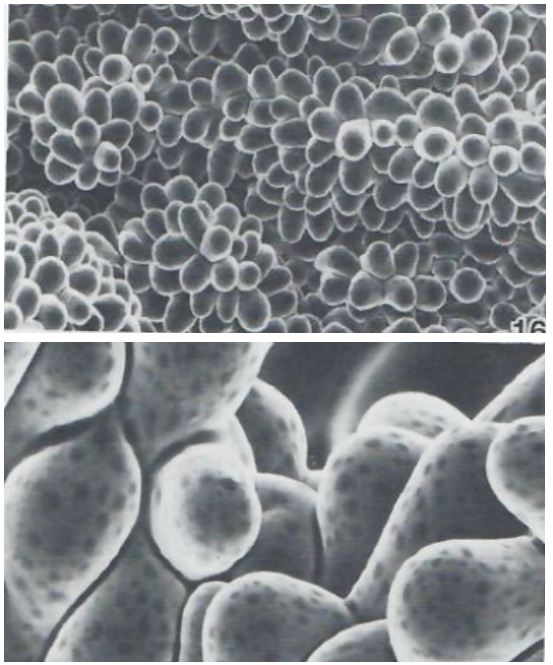
Polito, 1998

Pistillate (Female) Flowers



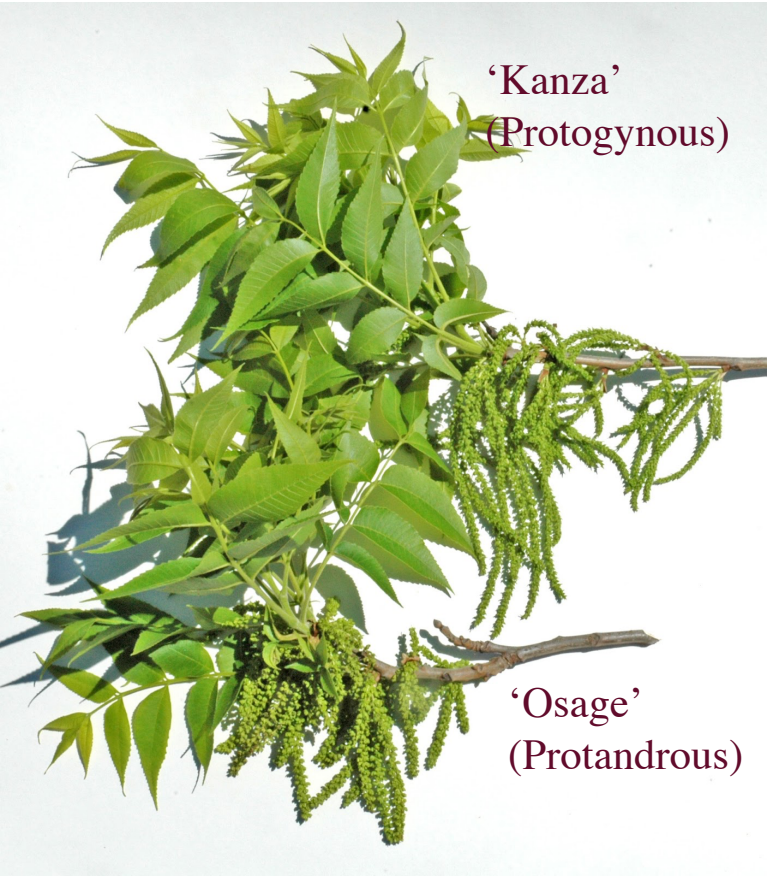
Woodroof and Woodroof, 1926

Stigmatic surface cells

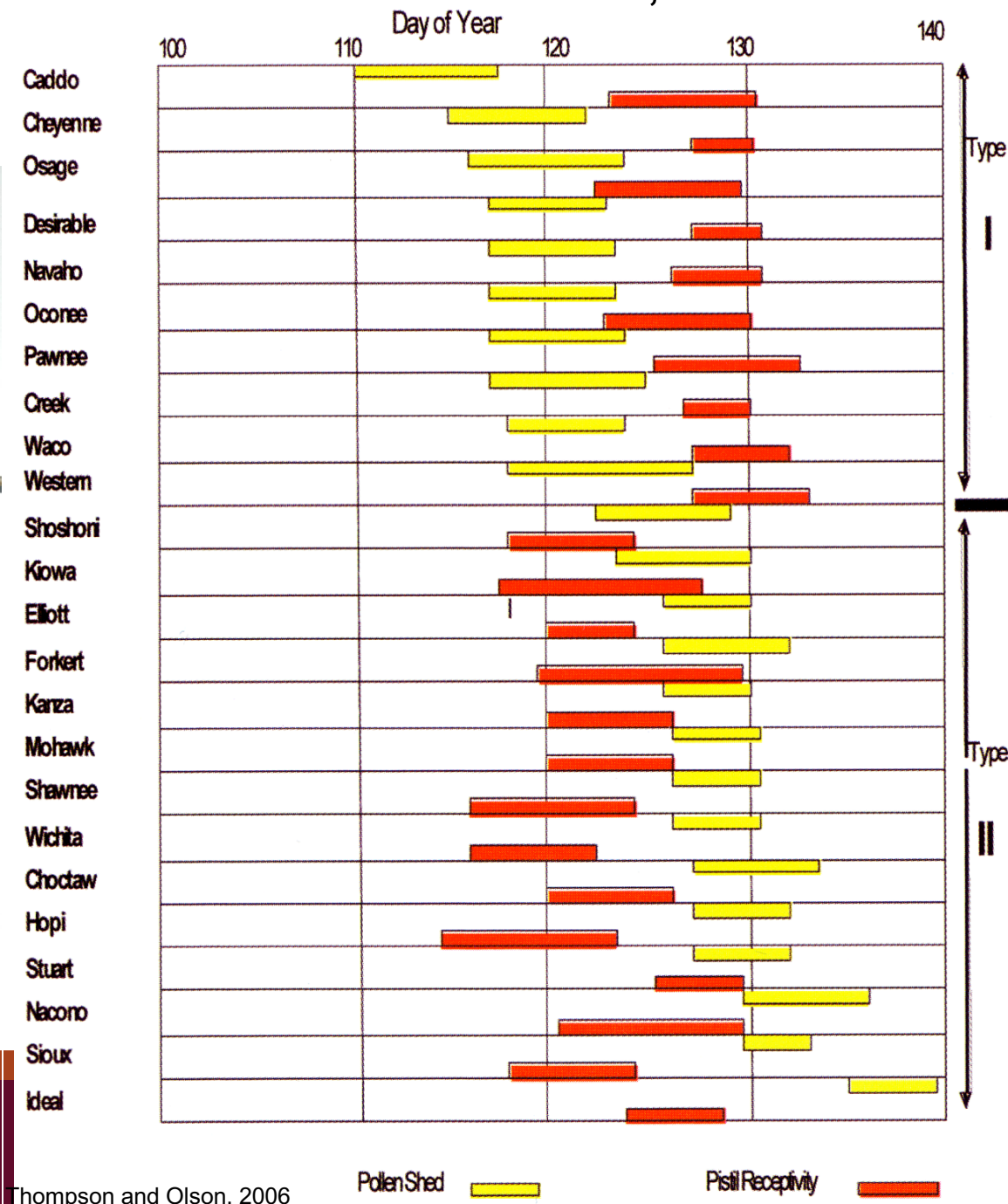


Wetzstein and Sparks 1986

Dichogamy and Outcrossing



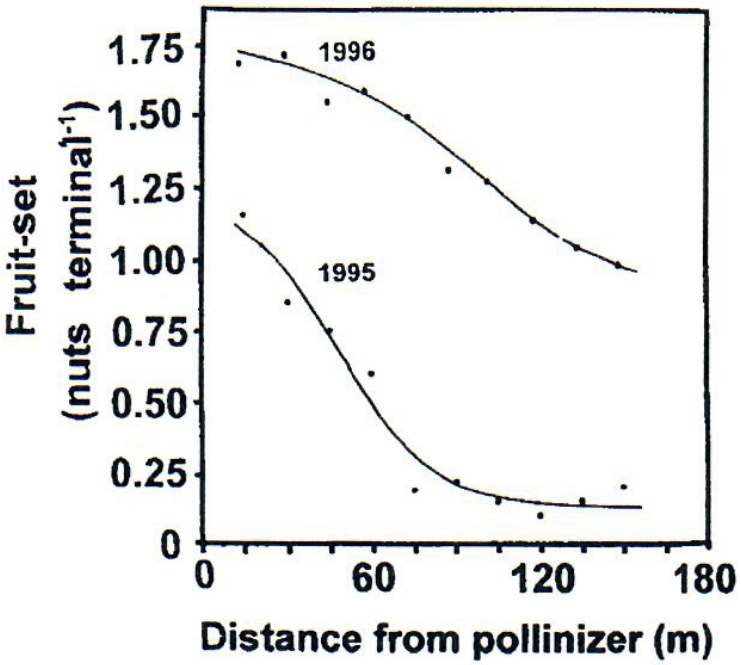
http://northernpecans.blogspot.com/2012/04/flowering-type-and-catkin-shape.html



Thompson and Olson, 2006

Distance from Pollinizer

- Greatly reduced fruit set occurs for pecan trees when planted more than about 160 feet from pollinizers.



Fruit set in a large block-type orchard of 'Desirable' as a function of distance from the pollinizer ('Stuart'). Wood (1997).

The Down-Side of Self Pollination

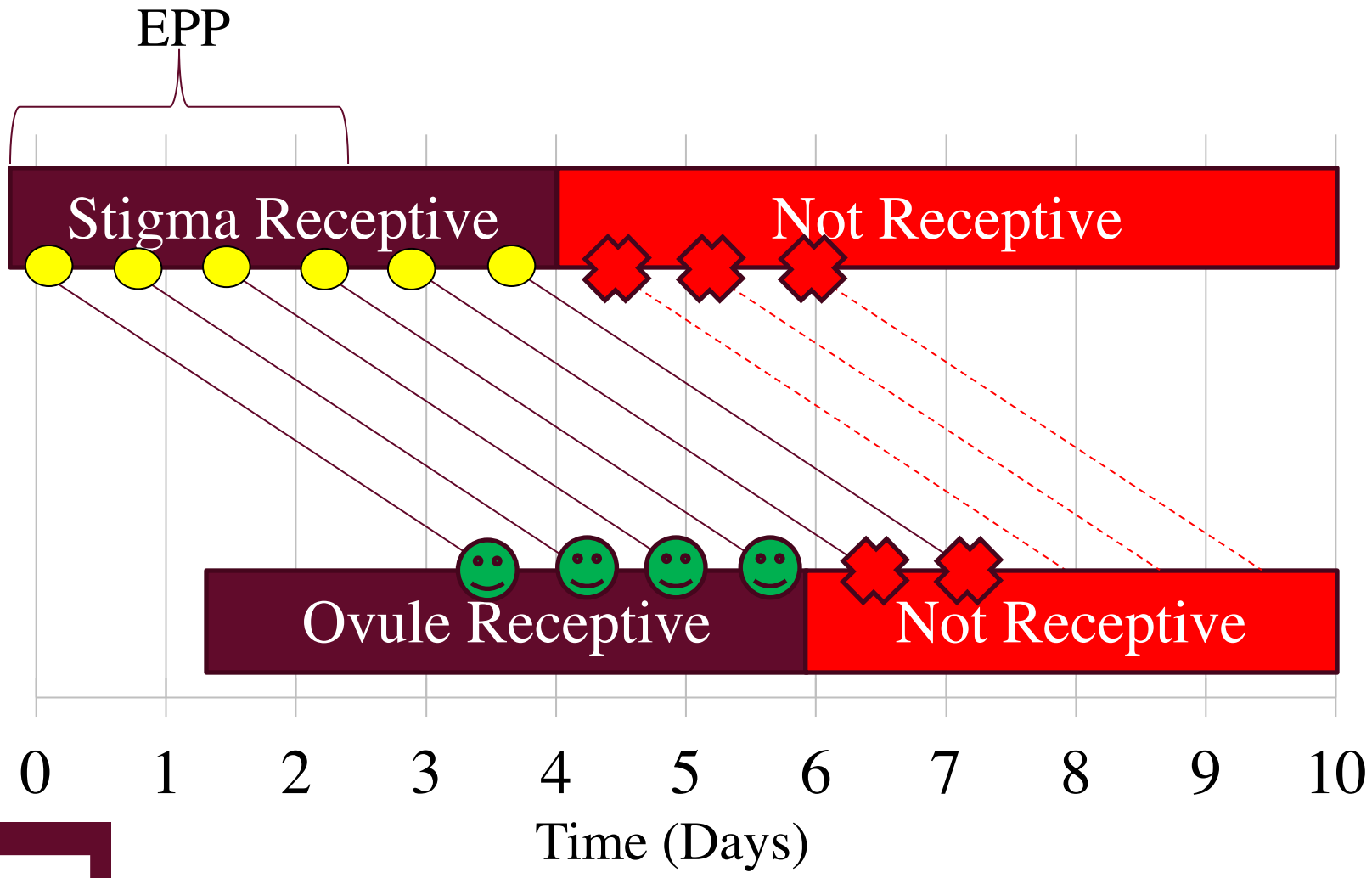
Self-pollination reduces nut quality and percent fruit set!

Table 1. Characteristics of nuts produced from controlled crosses with 'Western' as the female parent.

Average nut characteristic	Male parent	
	Western	Wichita
Weight (g)	5.35	6.45**z
Volume (ml)	7.43	8.34**
Specific gravity	0.72	0.77*
Pops[y] %	11.70	3.60[NS]

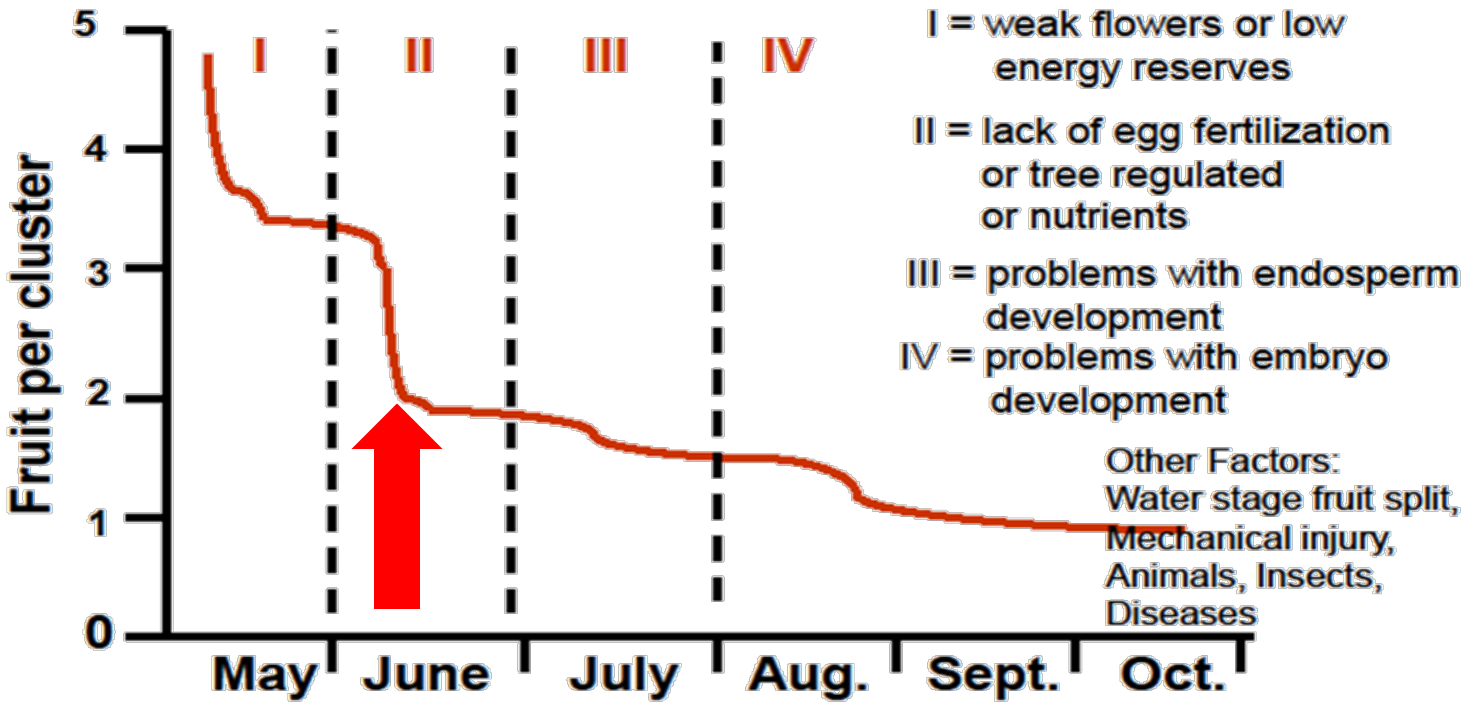
Marquard, 1988.

Effective Pollination Period



How can you know if pollination is limiting cropping in your orchard?

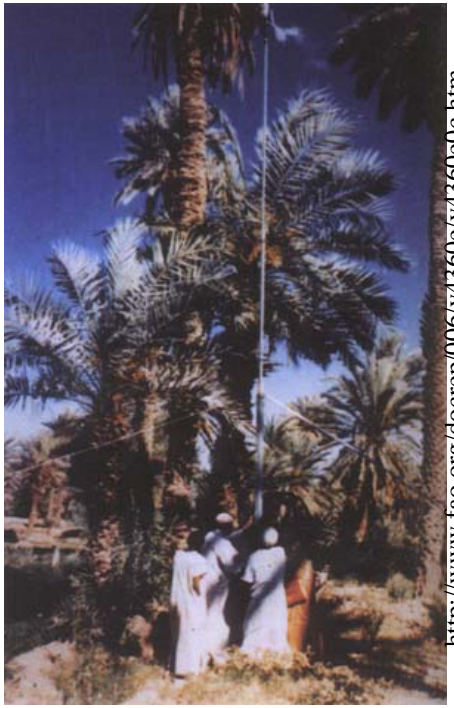
Physiological Fruit Drop Periods



Bruce Wood

What about "Artificial" or Supplemental Pollination?

http://cls.casa.colostate.edu/transgeniccrops/history.html



http://www.fao.org/docrep/006/y4360e/y4360e0c.htm

http://www.goodfruit.com/precision-pollination/

http://www.firmanpollen.com/application-equipment.html

TWENTIETH
WESTERN PECAN CONFERENCE
PROCEEDINGS

MARCH 1986

NEW MEXICO STATE UNIVERSITY

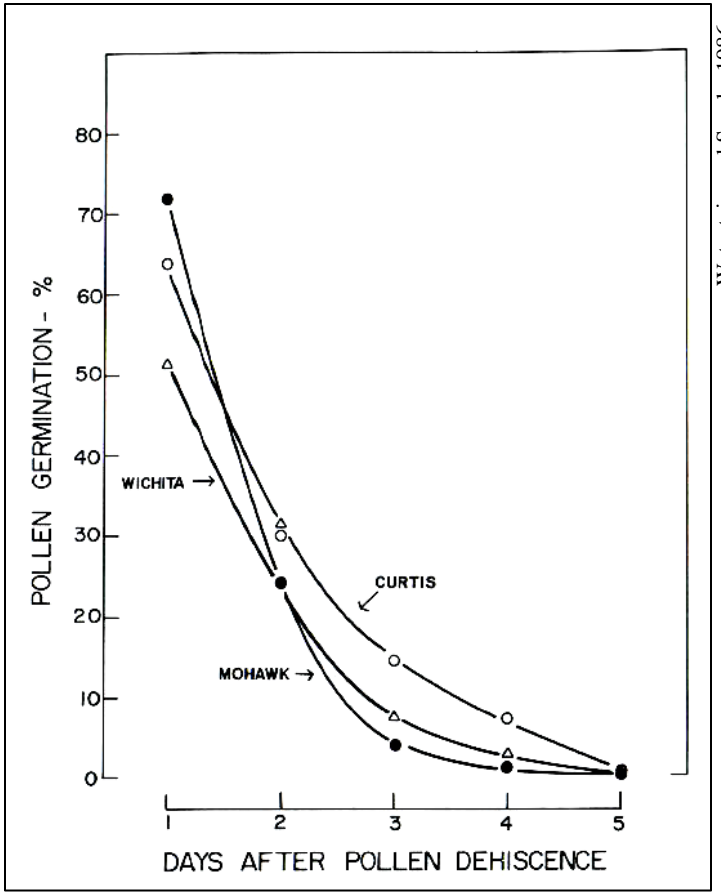
COOPERATIVE EXTENSION SERVICE
and
WESTERN IRRIGATED PECAN GROWERS ASSOCIATION

Artificial Pollination

- Artificial pollination may be beneficial in orchards where there are:
  - The wrong pollinizer cultivars
  - Too few pollinizers
  - Poorly placed pollinizers
  - Low pollen availability due to a bad weather event.

Artificial Pollination

- Pollen Collection and Storage:
  - Collection
    - Collect catkins at early stages of natural pollen shed.
  - Drying
    - Dry for a few hours at moderate temps (<95F or <35C).
    - Desiccating silica packets may help.
    - Screen out debris.
  - Storage
    - Store in sealed glass or plastic containers.
    - May be kept in refrigerator (5C) for only a few months.
    - May be kept in freezer (-4 to14F or -20 to -10C) for at least a couple years.



Wetzstein and Sparks 1986

Pollen germination versus time in storage at room temperature.

Artificial Pollination

- Viability Determination
  - Simple *in vitro* germination and histochemical tests may be done to ensure that pollen is viable.

- Application
  - Pollen should be dry applied a couple of times during pistillate flower receptivity period.
  - Commercial recommendations are to apply 25-50g of pollen per acre.
  - Methods:
    - Pollen puffers
    - Electrostatic sprayers
    - From airplanes or helicopters

Artificial Pollination

Is it possible to have too much of a good thing?

- Pistillate Flower Abortion (PFA)
  - Excessive pollen loads can cause some walnut varieties to shed pistillate flowers.
  - 'Serr' reportedly can lose as much as 90% (!) flowers due to PFA.
  - There is *some* evidence that PFA can happen in pecan too, but it is not likely in normal field conditions.

Questions?