

Avocado Flowering

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THE FLOWER

The avocado flowering behavior is atypical in many ways. The mature tree may produce in excess of a million flowers during the flowering period. The flowers occur in panicles of several dozens to hundreds of flowers borne on two different types of avocado inflorescences: determinate and indeterminate (Figure 1). In a determinate inflorescence, the tip of the shoot that bears the flowers will end in a floral bud. Indeterminate inflorescences, which tend to be more common in our environment, terminate with a vegetative bud.

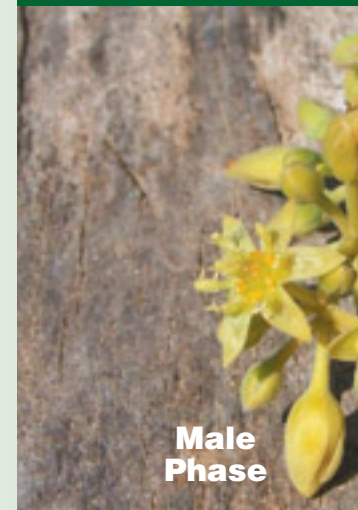
The avocado flower has both functional male and female organs. The male floral organ, which produces pollen, is comprised of the anthers and stamens. The female floral organ is comprised of the stigma (which receives the pollen), style and the ovary. The avocado exhibits a type of flowering behavior known as “synchronous dichogamy.” An individual flower will normally open twice over a period of two days with distinct timing of the male and female phases under normal temperatures. When the flower first opens it is in the female phase and the stigma is receptive to pollen. At the end of the female phase, which typically lasts up to four hours, the flower will close. On the second day the same flower re-opens in the male phase and sheds its pollen. See Figures 2 and 3 for an illustration of the female and male-phase flowers.

The avocado is also unusual in that the timing of the male and female phases differs among varieties. There are two flowering types, referred to as “A” and “B” flower types. “A” varieties open as female on the morning of the first day. The flower closes in late morning, and will remain closed until the afternoon of the following day when it opens as a male. “B” varieties open as female on the afternoon of the first day, close in late afternoon and re-open in the male phase the following morning. See Figure 4 for a diagrammatic representation.

FIGURE 1
Example of determinate and indeterminate inflorescences in avocado



FIGURE 2
Examples of male and female-phase



There are hundreds of open flowers on an avocado tree at any one time. Figure 5 shows the interaction between complementary varieties in the field. The arrows in the figure denote the movement of pollen between “A” and “B” flower types.

WHAT ARE THE PRACTICAL RAMIFICATIONS?

Table 1 lists some of the common commercial varieties and their flower type. The avocado’s flowering behavior is believed to promote cross-pollination since the male and female phases of an individual flower occur at different times within a given variety. It is believed that the interplanting of complementary flower types can boost fruit set and therefore yield by making pollen available when female flowers are receptive. The variety that provides pollen to the female-phase flower is termed the “pollinizer” (Figure 6).

FIGURE 4
Timing of avocado flowering for (A) and (B) flower types

Flower-type cultivar	DAY 1		DAY 2	
	MORNING	AFTERNOON	MORNING	AFTERNOON
“A”	♀			♂
“B”		♀	♂	

FIGURE 6
Pollination terms



Pollinizer:
A cultivar that donates pollen to another cultivar



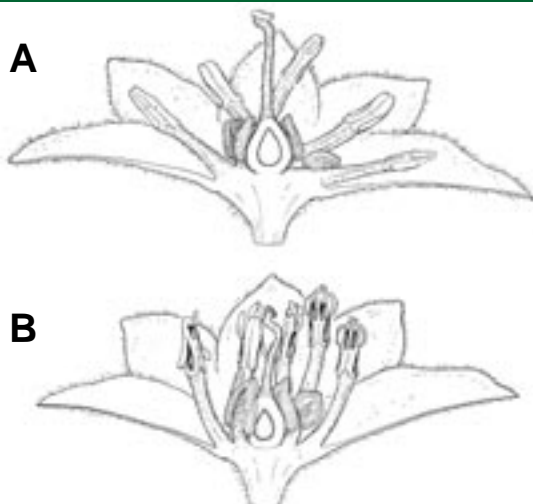
Pollinator:
The organism which transfers pollen from the male to the female-floral organ

FIGURE 5
A honey





FIGURE 3
Diagrammatic representation of the female (A) and male (B)-phase flowers in avocado



explain why solid blocks of a single variety sometimes set abundantly. This phenomenon has been demonstrated under controlled temperature conditions by researchers in Australia for Hass and Fuerte. Finally, most of the currently available “B” varieties are classified as greenskins, which bring low returns to growers. There are two “B” varieties that produce a black Hass-like fruit currently under evaluation by the UC Breeding Program, Nobel and Marvel, previously known as BL667 and BL516. They have been included in a pollinizer trial in Ventura County comparing many of the commonly-used pollinizer varieties.

Do we need pollinators?

The separation in time of the male and female phases has led most observers to believe that a **pollinator** is required to move pollen from a male-phase flower to a female-phase flower (Figure 7). The European honey bee is the commonly used pollinator. Data from the pollinizer trial in Ventura suggest that the proximity of pollinizers to the Hass trees may significantly influence yield. Honey bees tend to forage in a relatively small radius of one to four trees and having pollinizer trees in close proximity will increase the potential for cross pollination.

There is much yet to learn about the flowering behavior of the avocado including questions regarding the necessity for pollinizer varieties and their spatial placement in the orchard. Additionally, the use of pollinators and their placement in the orchard needs further elucidation. 🐝

A portion of the research presented was funded, in part, by a grant-in-aid from the California Avocado Commission.



FIGURE 5
The sequence of timing for (A) and (B) flower types under field conditions

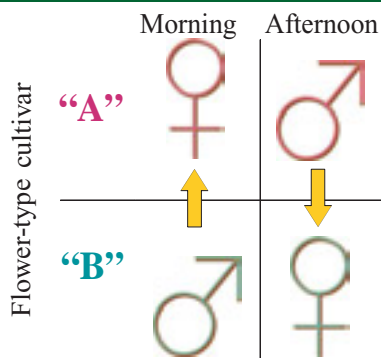


Table 1: Avocado varieties and flowering types

“A” VARIETIES	“B” VARIETIES
Hass	Bacon
Gwen	Ettinger
Lamb Hass	Fuerte
Pinkerton	Sharwil
Reed	SirPrize
	Walter Hole
	Zutano

The planting of pollinizer varieties is controversial from several standpoints. First, there is much discussion as to whether the planting of pollinizer varieties is worthwhile to enhance productivity. Some argue that solid blocks of a single variety, like Hass, will yield adequately. A recent study conducted in South Africa would support this contention. However, there is ample evidence from research conducted in Israel and California that including pollinizer varieties in the block enhances yields.

Under certain environmental conditions flower phases may overlap, allowing for close pollination, which is pollination within a single variety. This may help

E 7
Visiting a male-phase Ettinger flower

