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Flowering Dates and Overlapping Flowering Periods of Selected Avocado (*Persea americana*) Cultivars in Homestead, Florida

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The synchronous dichogamous flowering behavior of avocado trees promotes outcrossing and improves yields of many commercial avocado cultivars. To optimize cross-pollination, complementary cultivars (designated as Type A or B) must be planted in close proximity to each other. For a number of Florida avocado cultivars, the period of flowering is not known, making recommendations for planting arrangements for Type A and Type B cultivars difficult. From December through April of 2011 and 2012, trees of 14 avocado cultivars in several Homestead groves were monitored during their flowering period. 'Arue', 'Donnie', 'Nesbitt', 'Peterson', 'Russell', and 'Simmonds' began to flower during January, whereas 'Bernecker', 'Beta', 'Brogdon', 'Lisa', 'Loretta', 'Miguel', 'Reed', and 'Tonnage' did not begin flowering until February; most cultivars were done flowering during early April. An example of overlapping flowering periods of complementary flowering types includes 'Tonnage' (B-type) and 'Donnie' (A-type) and 'Bernecker' (A-type) and 'Miguel' (B-type).

The synchronous dichogamous flowering behavior of avocado (*Persea americana*) has been well documented. Synchronous means all the flowers of a given cultivar behave the same way at the same time (i.e., synchronously). Dichogamy is when the stamens and pistils of an individual flower mature at different times, thereby preventing self-pollination. Although exposing some cultivars to cool temperatures may result in temporal overlap of the male and female stages of flowering within the same inflorescence (i.e., self- or close-pollination), the preponderance of evidence indicates that cross-pollination among complementary A and B type avocado cultivars generally results in the highest percentage of fruit set and yield (Borrone et al., 2008; Ish-Am and Lahav, 2011; Salazar-García et al., 2013; Stout, 1927).

In general, for successful cross-pollination among different cultivars to take place, four factors need to be considered: 1) flower type of the cultivars grown; 2) distance between complementary A- and B-type trees; 3) dates of flowering of the A- and B-type cultivars and; 4) daily temporal overlapping of the opening of the functional male and female flowers of the A- and B-type cultivars. In 1927, Stout (1927) reported the dates of flowering and temporal period of the functional male and female stage of flowering for a number of A- and B-type avocado cultivars. However, the dates of the flowering of more recently selected, commercially grown cultivars have not been documented. The objective of this study was to determine the dates of flowering of selected A- and B-type Florida cultivars not previously documented.

Materials and Methods

The flowering period of selected Florida avocado cultivars was monitored for the date of first open to last open flowers during December through April, 2010–11 and 2011–12; some cultivars were monitored only one year (Table 1). Twenty-five-year-old trees of selected avocado cultivars grown in a commercial orchard, 10- to 12-year-old trees in the avocado collection, and 36-year-old 'Peterson' trees in an experimental orchard at the University of Florida, Tropical Research and Education Center (UF/TREC) in Homestead were used to monitor flowering periods. Flowering was monitored every 2 to 3 weeks. During that time, ambient mean and average minimum temperatures were recorded by the Florida Agricultural Weather Network (FAWN) weather station located at UF/TREC.

Table 1. Avocado cultivars and flowering type monitored during the 2011 and 2012 flowering period in Homestead, FL.

Year flowering period monitored	Cultivar	Flowering type
2011, 2012	Arue	A
2011, 2012	Bernecker	A
2011, 2012	Beta	B
2012	Brogdon	B
2011, 2012	Donnie	A
2011, 2012	Lisa	B
2011, 2012	Loretta	B
2011, 2012	Miguel	B
2011, 2012	Nesbitt	A
2011, 2012	Peterson	A
2011	Reed	A
2011	Russell	A
2011, 2012	Simmonds	A
2011, 2012	Tonnage	B

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Results and Discussion

Ambient temperatures. Average temperatures were 10 to 20 °F lower in late January/early February and March in 2011 than late January/early February and March 2012 (Fig. 1). Similarly, mean minimum temperatures were 10 to 25 °F cooler during late January and mid-March of 2011 than in 2012 (Fig. 2). Cool temperatures (e.g., <68 °F day/57 °F night) have been shown to delay growth and development of avocado trees (Salazar-García et al., 2013; Schaffer et al., 2013).

Flowering periods. In general, the main flowering period of most cultivars investigated was during February through March although 'Arue' flowered predominantly during Jan. 2011 and 2012 (Fig. 3). 'Brogdon' did not begin to flower until late February and 'Lisa' (during 2012) and 'Reed' until March. Of those cultivars monitored both years, the flowering period during 2012 was 2 to 4 weeks shorter compared to 2011. This may be attributed to the cooler average and mean minimum temperatures during flowering in the spring of 2011 compared to 2012 (Figs. 1 and 2). Thus cool weather during the mid-winter (January/February) and spring (March/April) of 2011 prolonged the flowering period compared to the warmer mid-winter and spring 2012 temperatures that may have accelerated flowering.

In summary, the flowering period overlapped to a substantial amount for most of the cultivars studied; for example 'Bernecker' (A-type), 'Donnie' (A-type), 'Nesbitt' (A-type) and B-types 'Beta', 'Miguel', and 'Tonnage' (Fig. 3). This information will be useful in planning future avocado plantings so A- and B-type cultivars with

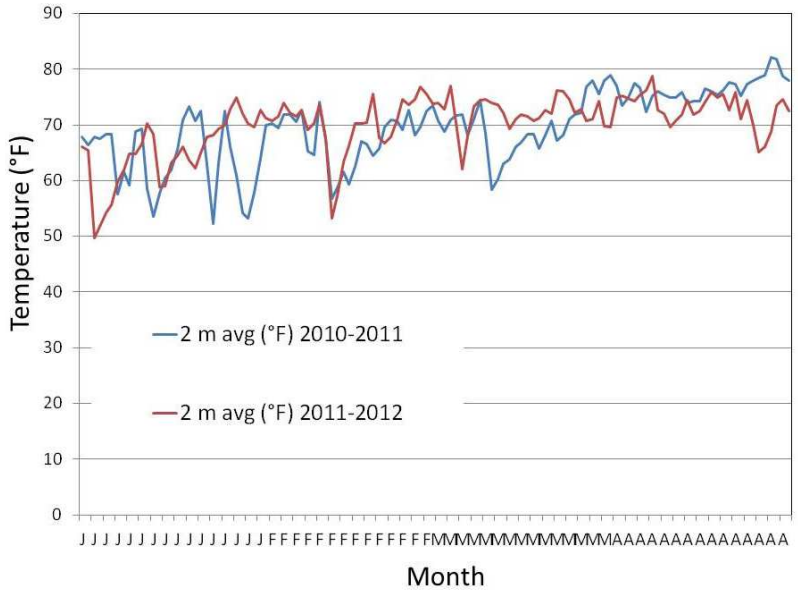

Fig. 1. Average ambient temperatures during October (O), November (N), December (D), January (J), February (F), March (M), and April (A) 2010–11 and 2011–12 at the UF/IFAS Tropical Research and Education Center FAWN site.

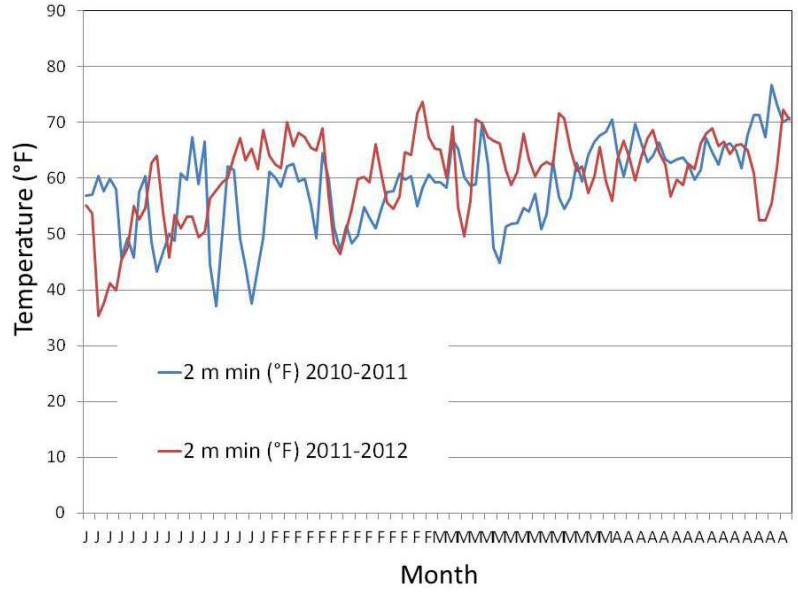

Fig. 2. Average minimum ambient temperatures during October (O), November (N), December (D), January (J), February (F), March (M), and April (A) 2010–11 and 2011–12 at the UF/IFAS Tropical Research and Education Center, FAWN site.

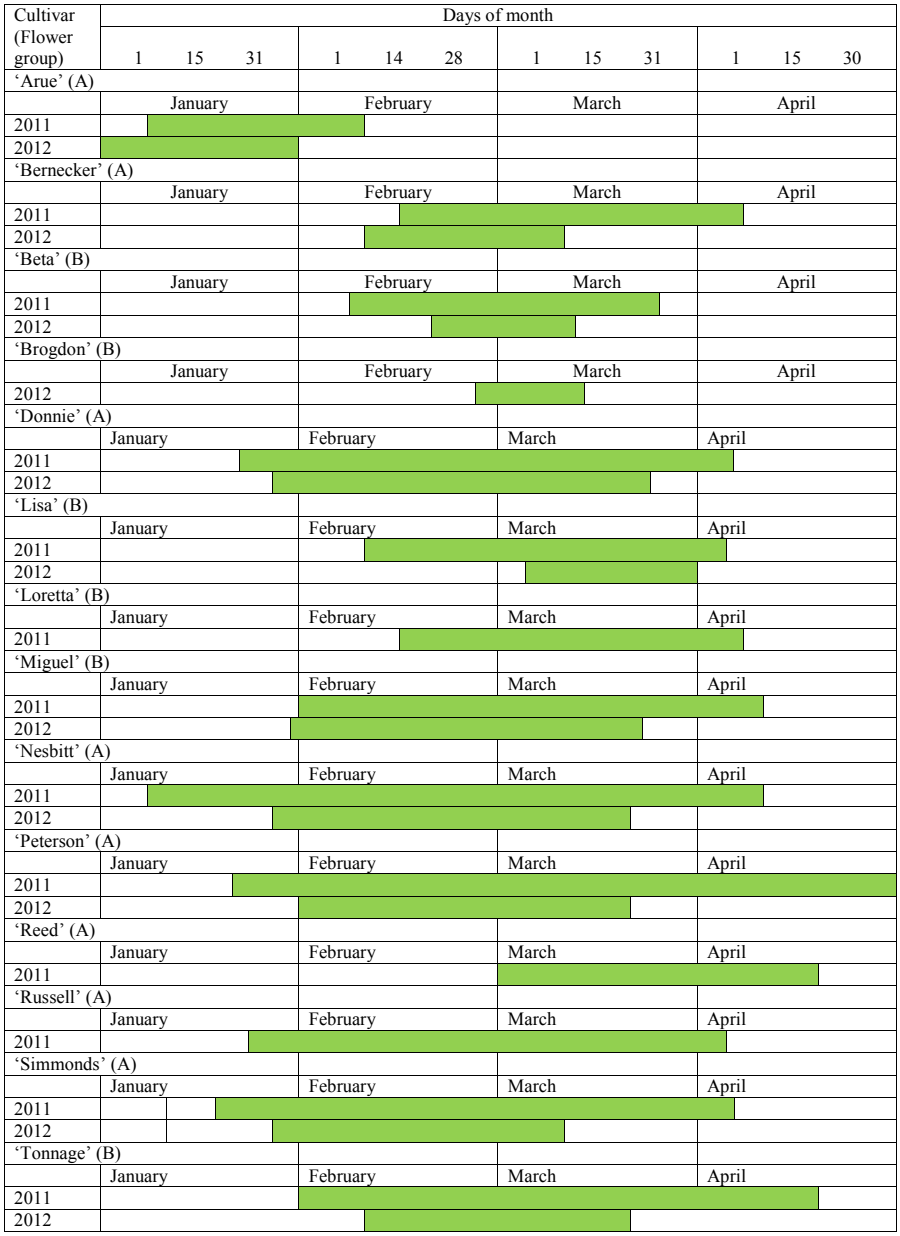

Fig. 3. Flowering period for selected avocado cultivars in Homestead, FL during 2011 and 2012.

overlapping flowering periods are planted nearby to potentially improve fruit set and crop yields. In contrast, 'Arue' (A-type) generally flowers earlier and completes flowering before most of the B-type cultivars studied (e.g., 'Beta', 'Brogdon', 'Lisa', 'Loretta', 'Miguel', and 'Tonnage') flowered. It may be that the flowering period of other B-type cultivars will be more suitable for 'Arue' than those currently investigated. In the future there is a need to monitor the daily temporal overlapping of the opening of the functional male and female flowers of these cultivars to more precisely determine which complementary Type A and B cultivars have the best potential to improve fruit set and crop yields.

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