

Palmer amaranth growth, escapes, and seed production

July 15, 2019 – Lynn Sosnoskie, UCCE Merced and Madera Counties

Cotton is susceptible to weed interference as many weed species can outgrow and outcompete the newly germinated seedlings. This includes a weed native to California - Palmer amaranth (*Amaranthus palmeri*) - whose season-long germination, high rate of photosynthesis and rapid growth makes it a significant crop competitor. Palmer amaranth interference significantly affects the growth and yield of most agronomic crops, with cotton being one of the more sensitive commodities.

Palmer amaranth is an erect pigweed species (growing to heights > 8'). Stems are hairless and range from green to red in color. Leaf shape can be variable, but most leaves are egg-, diamond-, or lance-shaped and may exhibit a white, chevron-shaped watermark. Leaf petioles (especially on older leaves) are as long or longer than the leaf blades (this is a trait for distinguishing the species from other amaranth species). Palmer amaranth produces male and female flowers on separate plants. Flowers are held on long (up to 2-3' in length) terminal flower spikes (or on spikes that arise from upper leaf axils). Female Palmer amaranth flower heads are instantly recognizable by the presence of sharp bracts. For more information about identifying amaranths see: <https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=27501>.



Figure 1. Palmer amaranth flower spike rising above a developing corn canopy; petiole length longer than the length of the leaf blade; close-up of male (left) and female (right) flowers (note the presence of sharp bracts for the females).

Driving around the San Joaquin Valley, I have noticed fields with Palmer amaranth plants rising above crop canopies (mainly tomatoes, sweet potatoes, and cotton). Populations with resistance to glyphosate have been identified in the in California, which could explain escapes in some systems. Even without the development of herbicide resistance, Palmer amaranth may escape chemical control because it can grow, rapidly, and exceed the height recommendations for many foliar-applied herbicides in very short periods of time.

For example, in a recent study to describe CA Palmer amaranth growth in response to emergence date (April 24, May 2, June 2, June 21, 2019), all observed Palmer amaranth plants reached a height of 3 inches by 6-10 days after emergence (DAE) (Figure 2). Palmer that emerged on April 24th and May 2nd reached a height of 6 inches 14-16 DAE whereas Palmer amaranth that emerged on June 2nd and June 24th reached a height of 6 inches by 10 -12 DAE (Figure 2). If regressed against DAE, Palmer amaranth that emerged in June grew at a rate of more than an inch per day (Figure 2). To

better visualize how quickly Palmer amaranth can become established, please visit the following University of Illinois page documenting Palmer amaranth growth in photo form: <http://bulletin.ipm.illinois.edu/?p=2024>.

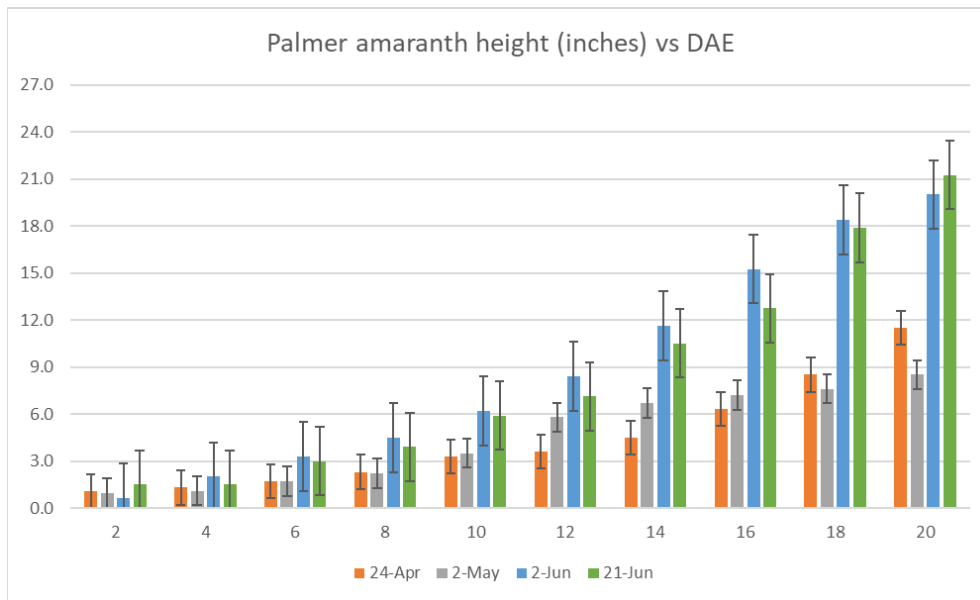


Figure 2. Palmer amaranth plant heights at 2-20 DAE as affected by emergence date. Mean daily minimum and maximum temperatures for the April 24th and May 2nd emergence cohorts were 54 and 84 F and 51 and 77 F, respectively. The average daily minimum and maximum temperatures for the June 2nd and 24th emergence cohorts were both 61 to 92 F.

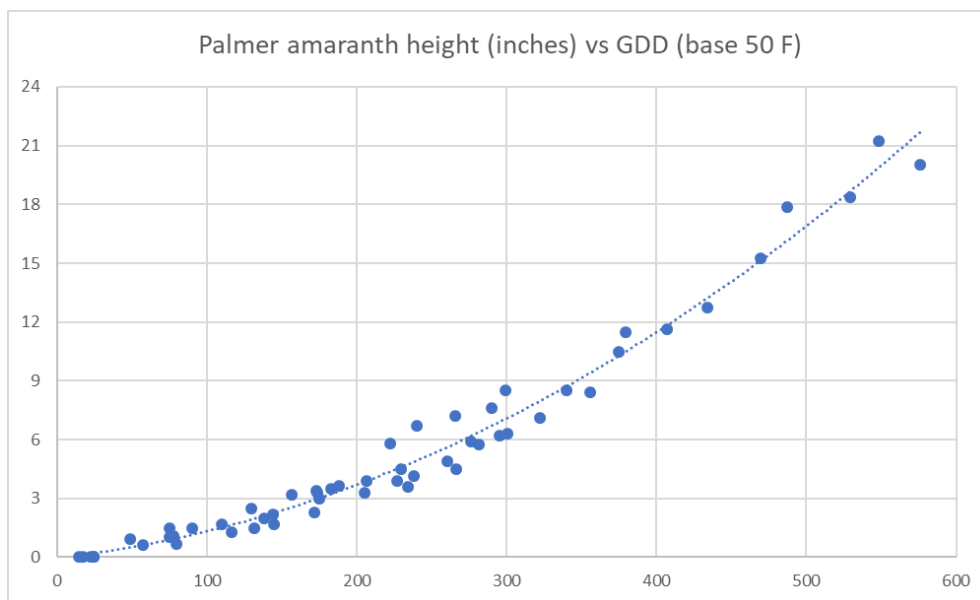


Figure 3. When Palmer amaranth plant heights were regressed against accumulated growing degree days (assuming a base temperature of 50F) results indicated that Palmer amaranth requires 175 to 180 GDD to achieve a height of 3 inches and 270 to 275 GDD to reach a height of 6 inches.

For more information about growing degree day calculators see: <http://ipm.ucanr.edu/WEATHER/index.html>.

If Palmer amaranth escapes herbicide (or cultivation) treatments, hand-weeding may be needed to prevent Palmer amaranth from producing seed that can be returned to the soil seedbank. Remember: female Palmer amaranth can produce more than 500,000 seed per plant, which can support an infestation for many years to come. When hand-weeding, plants should, ideally, be removed from the field to prevent them from re-rooting and re-establishing. Even plants that are cut off at or near the base of the stem with a hoe can re-sprout and set significant amounts of seed <https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=27583>.

Palmer amaranth is a significant problem in many production systems, including cotton. Sites with substantial infestations should use an integrated weed management program to reduce the density of plants that can compete with the crop <http://ipm.ucanr.edu/PMG/r114700111.html>. Escapes are not uncommon as Palmer amaranth can grow rapidly and outpace many control efforts. If plants become established in the field and hand-weeding is necessary, be sure to remove as much of the weed biomass as possible to prevent plants from growing and achieving reproductive maturity.