EFFECTS OF COMPENSATORY GROWTH ON PALMER AMARANTH BIOMASS AND ACCUMULATION AND COTTON YIELD

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Introduction

Palmer amaranth is a highly competitive weed of field corn, peanut, soybean and, especially, cotton. Biotypes resistant to glyphosate have been confirmed in nearly every agronomic county in GA. Palmer amaranth establishment success is due, in part, to the presence of a deep taproot, which helps it to penetrate compacted soils, thereby gaining access to water and nutrients more effectively than many commonly grown crops. The presence of a taproot can make it difficult to remove Palmer amaranth by hand. Growers, extension agents, and university research personnel have observed instances where: 1) previously pulled Palmer amaranth plants have re-rooted and become reestablished in a field and 2) plants that have been cut back (using hoes or machetes) have re-sprouted from dormant buds and resumed normal growth. Current GA recommendations for Palmer amaranth management stress the need to remove all plants from a field prior to their achieving reproductive maturity in an effort to mitigate the size of the soil seedbank. Plants that escape removal can flower and produce progeny that could severely impact the following year's crop. The objective of this study was to evaluate the potential of Palmer amaranth to grow and develop following defoliation occurring during a simulated hand-weeding failure.

Materials and Methods

This study was conducted in four fields planted to glufosinate-tolerant cotton in Tifton, Ty Ty, and Plains, GA in 2011. A density of ten Palmer amaranth plants per plot (minimum of 20 ft. in length and four rows wide) were established in the center two rows of each experimental unit (five plants per row). Plots were maintained weed free, except for the selected Palmer amaranth, by hand-weeding. At the start of Palmer amaranth flowering (June to August), plots were randomly assigned to one of four defoliation treatments: 1) no defoliation [Intact], 2) removal of all stem and leaf tissue to the soil line [Soil], 3) removal of all stem and leaf tissue to a height of one inch above the soil line [1"], and 4) removal of all stem and leaf tissue to a height of six inches above the soil line [6"]. Each treatment was replicated three to six times at each site. Plant heights were recorded regularly throughout the remainder of the growing season. Floral tissues from female plants (inflorescences and seed) were harvested when seeds were 50 to 75% mature, but before plant senescence. Tissue was air dried in a greenhouse and the seed from each plant sieved through18, 20, 35, and 40 mesh screens. Following the removal of all chaff, total seed mass and number were determined. Cotton was harvested from the center two rows of each plot and yield determined.

Results and Discussion

Averaged across all sites, Palmer amaranth plants were approximately 55 inches in height when the defoliation treatments were initiated. By six weeks after cutting (WAC), the intact plants were, on average, almost 85 inches tall (Figure 1). Averaged over all locations, plants cut back to the soil line, and 1" and 6" above the soil line were, approximately, one, 25, and 50 inches in height 6 WAC (Figure 1). Palmer amaranths that were allowed to grow and develop normally produced an average of 394,000 seeds/plant; plants cut back to the soil line, and 1" and 6" above the soil line produced an average of 22,000, 36,000, and 129,000 seeds/plant, respectively (Figure 2). Cotton yield was significantly reduced by the presence of Palmer amaranths that were allowed to compete with the crop throughout the entirety of the growing cycle. Average cotton yield was between 2,500 and 3,000 lb./A in plots where Palmer amaranths had been physically defoliated at the time of flowering; cotton yields of 1,500 lb./A were recovered from plots where Palmer amaranth plants were left intact (Figure 3).

Palmer amaranth can be difficult to remove by hand weeding. Growers and university personnel have observed hand-weeding and mechanical removal failures in which previously pulled Palmer amaranth plants have re-rooted and become re-established and/or plants that have been cut or pruned back have re-sprouted from latent buds. Results from this field study show that Palmer amaranth plants cut back (all stem and leaf tissue removed) to one and six inches above the soil line are able to successfully regrow and achieve reproductive maturity. Although the defoliated plants never achieved the same size as their intact counterparts, they were still able to produce significant amounts seed. Current control recommendations urge cotton growers to remove Palmer amaranth plants escaping early season control measures by hand to try and reduce the size of the residual seedbank. Growers need to be aware that ineffectual salvage attempts could negate efforts designed to manage the size of Palmer amaranth populations in the field.

Figure 1. Average plant height (across four locations), in inches, of Palmer amaranths that were left intact, cut back at flowering to the soil line, or cut back to one and six inches above the soil line as recorded throughout the growing season.

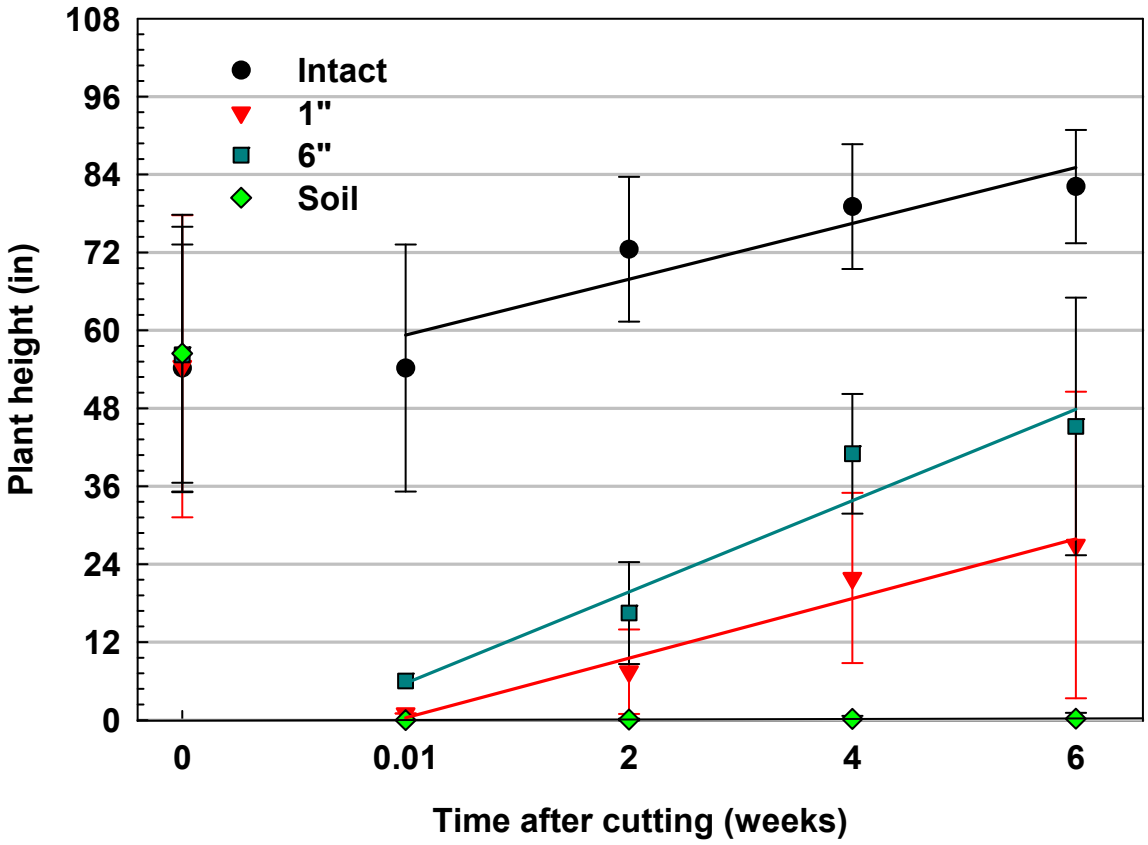

Figure 2. Average (across four locations) seed produced/plant, in grams, by Palmer amaranth plants that were left intact, cut back at flowering to the soil line, or cut back to one and six inches above the soil line.

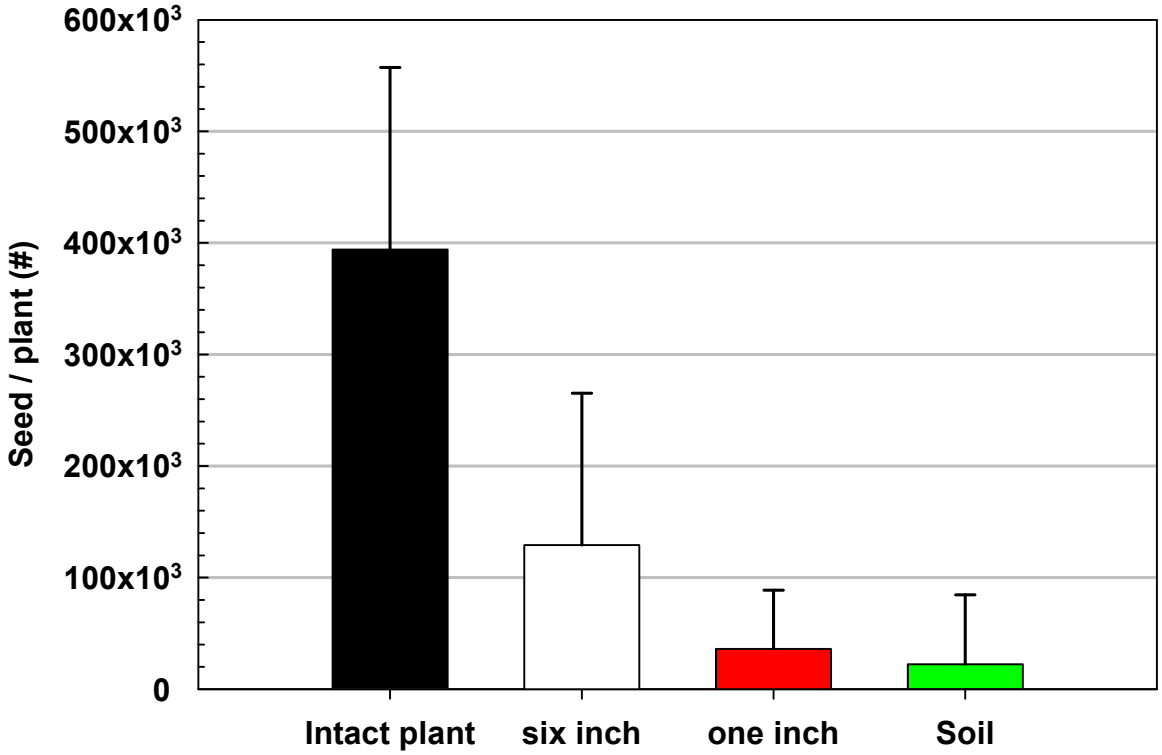

Figure 3. Average (across four locations) cotton yields, in lb./A, when Palmer amaranth plants were left intact, cut back at flowering to the soil line, or cut back to one and six inches above the soil line.