**Soybean density and Palmer amaranth(*Amaranthus palmeri*) establishment time: Effects on weed biology, crop yield and economic returns.**

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**Supplemental Table 1**. Parameter estimates of the linear regression model for the effects of crop density on *A. palmeri* height (at harvest) in weeks after (crop) emergence (WAE) of the weed relative to soybean emergence

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| WAE | Intercept | Slope | Intercept Std Error | Slope Std Error | Intercept t Ratio | Slope t Ratio |
| 0 | 142.9 | -6.1E-05 | 4.542 | 2.03E-05 | 31.456 | -2.986 |
| 1 | 125.5 | -9.8E-05 | 4.231 | 1.92E-05 | 29.664 | -5.068 |
| 2 | 103.3 | -0.00016 | 4.272 | 2E-05 | 24.184 | -7.901 |
| 4 | 55.1 | -0.0001 | 4.228 | 1.96E-05 | 13.013 | -5.223 |
| 6 | 48.0 | -9.4E-06 | 4.243 | 1.94E-05 | 11.323 | -0.484 |
| 8 | 51.1 | -3.4E-05 | 4.253 | 1.96E-05 | 12.005 | -1.742 |

**Supplemental Table 2**. Parameter estimates of the two-parameter exponential decay model for the effects of crop density on *A. palmeri* dry weight (at harvest) in weeks after emergence (WAE) of the weed relative to soybean emergence

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| WAE | Upper value | Slope | Upper value Std Error | Slope Std Error | Upper value t Ratio | Slope t Ratio |
| 0 | 175.3 | -4.2E-06 | 9.718 | 4.92E-07 | 18.042 | -8.620 |
| 1 | 135.4 | -9.7E-06 | 9.305 | 1.54E-06 | 14.555 | -6.277 |
| 2 | 94.6 | -1.6E-05 | 9.361 | 5.06E-06 | 10.106 | -3.184 |
| 4 | 12.3 | -1.4E-05 | 9.353 | 3.15E-05 | 1.312 | -0.458 |
| 6 | 1.2 | -1.5E-06 | 8.196 | 4.04E-05 | 0.142 | -0.037 |
| 8 | 0.610934 | -1.2E-06 | 8.098 | 7.32E-05 | 0.075 | -0.016 |

**Supplemental Table 3**. Parameter estimates of the two-parameter exponential decay model for the effects of crop density on *A. palmeri* seed production (at harvest) in weeks after emergence (WAE) of the weed relative to soybean emergence

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| WAE | Upper value | Slope | Upper value Std Error | Slope Std Error | Upper value t Ratio | Slope t Ratio |
| 0 | 352817.5 | -5.5042E-06 | 11688.823 | 3.87343E-07 | 30.184 | -14.210 |
| 1 | 248035.2 | -9.8853E-06 | 12855.638 | 1.13049E-06 | 19.294 | -8.744 |
| 2 | 236084.7 | -1.7437E-05 | 17110.988 | 3.10137E-06 | 13.798 | -5.622 |
| 4 | 1830.093 | 1.30592E-06 | 13293.131 | 2.58329E-05 | 0.138 | 0.050 |
| 6 | 543.0582 | -2.4689E-06 | 26062.138 | 0.00023618 | 0.021 | -0.010 |
| 8 | 108.5907 | 4.35036E-06 | 7952.0331 | 0.00022556 | 0.014 | 0.019 |



**Supplemental Figure 1**. Effects of *A. palmeri* establishment time × soybean density on soybean dry weight at R2-R3 and R6 reproductive crop growth stages. Vertical bars indicate the LSD value for mean separation between soybean densities and each reproductive stage only at P<0.05.

Average low density achieved for 2014 was 121302 plants ha-1 (120311, 122292) and for 2015 was 98437 plants ha-1 (96117, 100758); average medium achieved for 2014 was 242604 plants ha-1 (241302, 243906) and for 2015 was 198229 plants ha-1 (193724, 202735) and finally average high density achieved for 2014 was 389333 plants ha-1 (386401, 392266) and for 2015 was 323167 plants ha-1 (314202, 332132). Numbers in the parentheses indicated the lower and upper 95 % mean respectively.



**Supplemental Figure 2**. Effects of *A. palmeri* establishment time × crop density on pod production plant-1 in weeks after emergence (WAE) of the weed relative to soybean emergence. Vertical bars represent LSD values for mean separation at P<0.05.

Average low density achieved for 2014 was 121302 plants ha-1 (120311, 122292) and for 2015 was 98437 plants ha-1 (96117, 100758); average medium achieved for 2014 was 242604 plants ha-1 (241302, 243906) and for 2015 was 198229 plants ha-1 (193724, 202735) and finally average high density achieved for 2014 was 389333 plants ha-1 (386401, 392266) and for 2015 was 323167 plants ha-1 (314202, 332132). Numbers in the parentheses indicated the lower and upper 95 % mean respectively.