**Supplementary material**

**Supplementary Table S1.** Palmer amaranth plant mortality assessments (%) ± standard error in response to PPO-inhibiting herbicides applied POST between 2020 and 2022 in Tifton, GA.a,b

|  |  |  |  |
| --- | --- | --- | --- |
| Rate (x) | Susceptible population |   | Suspected resistant population |
| Fomesafen | Lactofen | Acifluorfen | Trifludimoxazin |   | Fomesafen | Lactofen | Acifluorfen | Trifludimoxazin |
| 0.0039 | 5 ± 4 | 38 ± 10 | 66 ± 12 | 67 ± 8 |  | - | - | - | - |
| 0.0078 | 10 ± 6 | 45 ± 12 | 11 ± 5 | 86 ± 10 |  | - | - | - | - |
| 0.0156 | 32 ± 11 | 55 ± 11 | 23 ± 8 | 79 ± 10 |  | - | - | - | - |
| 0.0313 | 51 ± 15 | 65 ± 7 | 64 ± 12 | 87 ± 7 |  | 0 ± 0 | 0 ± 0 | 1 ± 1 | 13 ± 9 |
| 0.0625 | 45 ± 11 | 30 ± 10 | 38 ± 8 | 93 ± 4 |  | 5 ± 4 | 0 ± 0 | 5 ± 3 | 41 ± 9 |
| 0.125 | 33 ± 8 | 28 ± 8 | 77 ± 8 | 97 ± 2 |  | 0 ± 0 | 0 ± 0 | 0 ± 0 | 38 ± 7 |
| 0.25 | 71 ± 10 | 41 ± 8 | 85 ± 7 | 98 ± 2 |  | 3 ± 2 | 0 ± 0 | 5 ± 3 | 48 ± 8 |
| 0.50 | 79 ± 11 | 43 ± 10 | 95 ± 4 | 100 ± 0 |  | 7 ± 3 | 8 ± 3 | 4 ± 3 | 62 ± 11 |
| 0.75 | 82 ± 9 | 64 ± 11 | 93 ± 8 | 100 ± 0 |  | - | - | - | - |
| 1 | 92 ± 6 | 58 ± 10 | 90 ± 8 | 100 ± 0 |  | 4 ± 4 | 14 ± 5 | 7 ± 6 | 77 ± 8 |
| 2 | 88 ± 8 | 71 ± 10 | 98 ± 3 | 100 ± 0 |  | 16 ± 4 | 5 ± 3 | 5 ± 3 | 91 ± 7 |
| 4 | 100 ± 0 | 100 ± 0 | 100 ± 0 | 100 ± 0 |  | 11 ± 4 | 3 ± 2 | 1 ± 1 | 98 ± 2 |
| 8 | - | - | - | - |  | 7 ± 4 | 5 ± 2 | 16 ± 6 | 100 ± 0 |
| 10 | - | - | - | - |  | 16 ± 5 | 3 ± 3 | 12 ± 4 | 100 ± 0 |
| 20 | - | - | - | - |  | 58 ± 15 | 18 ± 9 | 80 ± 8 | 100 ± 0 |
| 40 | - | - | - | - |   | 63 ± 15 | 15 ± 6 | 91 ± 6 | - |

aAbbreviations: PPO, protoporphyrinogen oxidase; POST, postemergence; DAT, days after treatment.

bPalmer amaranth mortality assessments recorded 8 DAT. Field rates (1X) included fomesafen at 420 g ai ha-1, lactofen at 219 g ai ha-1, acifluorfen at 420 g ai ha-1, and trifludimoxazin at 25 g ai ha-1. Fomesafen and acifluorfen applications included nonionic surfactant (0.25% v/v), lactofen included crop oil concentrate (1% v/v), and trifludimoxazin included methylated seed oil (1% v/v). All experimental runs included a nontreated control for comparison.

**Supplementary Table S2.** Palmer amaranth fresh-weight biomass reductions (%) ± standard error in response to PPO-inhibiting herbicides applied POST between 2020 and 2022 in Tifton, GA.a,b

|  |  |  |  |
| --- | --- | --- | --- |
| Rate (x) | Susceptible population |   | Suspected resistant population |
| Fomesafen | Lactofen | Acifluorfen | Trifludimoxazin |   | Fomesafen | Lactofen | Acifluorfen | Trifludimoxazin |
| 0.0039 | 29 ± 10 | 46 ± 9 | 89 ± 3 | 77 ± 5 |  | - | - | - | - |
| 0.0078 | 32 ± 10 | 53 ± 9 | 64 ± 8 | 80 ± 5 |  | - | - | - | - |
| 0.0156 | 59 ± 12 | 55 ± 8 | 61 ± 9 | 80 ± 4 |  | - | - | - | - |
| 0.0313 | 73 ± 7 | 55 ± 10 | 81 ± 4 | 84 ± 2 |  | 21 ± 12 | 39 ± 11 | 33 ± 10 | 47 ± 10 |
| 0.0625 | 76 ± 6 | 77 ± 6 | 81 ± 5 | 95 ± 1 |  | 46 ± 11 | 40 ± 9 | 48 ± 11 | 51 ± 11 |
| 0.125 | 86 ± 3 | 69 ± 6 | 88 ± 3 | 96 ± 1 |  | 41 ± 14 | 34 ± 7 | 32 ± 9 | 62 ± 6 |
| 0.25 | 91 ± 3 | 80 ± 5 | 94 ± 1 | 97 ± 1 |  | 31 ± 9 | 29 ± 9 | 37 ± 10 | 79 ± 5 |
| 0.50 | 93 ± 2 | 87 ± 4 | 96 ± 1 | 96 ± 1 |  | 34 ± 7 | 34 ± 7 | 26 ± 6 | 83 ± 5 |
| 0.75 | 95 ± 2 | 94 ± 2 | 96 ± 1 | 97 ± 2 |  | - | - | - | - |
| 1 | 95 ± 1 | 92 ± 2 | 96 ± 1 | 97 ± 1 |  | 52 ± 8 | 38 ± 8 | 44 ± 9 | 83 ± 6 |
| 2 | 95 ± 1 | 95 ± 1 | 97 ± 1 | 97 ± 1 |  | 53 ± 11 | 23 ± 8 | 47 ± 8 | 92 ± 2 |
| 4 | 100 ± 0 |  ± 0 | 100 ± 0 | 100 ± 0 |  | 54 ± 9 | 30 ± 9 | 55 ± 6 | 91 ± 1 |
| 8 | - | - | - | - |  | 51 ± 9 | 36 ± 7 | 73 ± 5 | 93 ± 1 |
| 10 | - | - | - | - |  | 65 ± 6 | 34 ± 9 | 72 ± 7 | 88 ± 3 |
| 20 | - | - | - | - |  | 83 ± 9 | 63 ± 7 | 90 ± 3 | 87 ± 2 |
| 40 | - | - | - | - |   | 85 ± 5 | 64 ± 9 | 91 ± 4 | - |

aAbbreviations: PPO, protoporphyrinogen oxidase; POST, postemergence; DAT, days after treatment.

bPalmer amaranth fresh-weight biomass recorded 8 DAT. Field rates (1X) included fomesafen at 420 g ai ha-1, lactofen at 219 g ai ha-1, acifluorfen at 420 g ai ha-1, and trifludimoxazin at 25 g ai ha-1. Fomesafen and acifluorfen applications included nonionic surfactant (0.25% v/v), lactofen included crop oil concentrate (1% v/v), and trifludimoxazin included methylated seed oil (1% v/v). All experimental runs included a nontreated control for comparison.

**Supplementary Table S3.** Palmer amaranth plant mortality assessments (%) ± standard error in response to PPO-inhibiting herbicides applied PRE between 2020 and 2022 in Tifton, GA.a,b

|  |  |  |  |
| --- | --- | --- | --- |
| Rate (x) | Susceptible population |   | Suspected resistant population |
| Fomesafen | Flumioxazin | Oxyflurofen | Trifludimoxazin |   | Fomesafen | Flumioxazin | Oxyflurofen | Trifludimoxazin |
| 0.00137 | - | 35 ± 13 | 53 ± 8 | 20 ± 9 |  | - | - | - | - |
| 0.0041 | - | 41 ± 9 | 73 ± 5 | 90 ± 3 |  | - | - | - | - |
| 0.012 | 47 ± 2 | 94 ± 1 | - | - |  | - | - | - | - |
| 0.037 | 83 ± 2 | 100 ± 0 | 98 ± 0 | 100 ± 0 |  | 33 ± 7 | 20 ± 4 | 82 ± 4 | 19 ± 7 |
| 0.11 | 98 ± 1 | 100 ± 0 | - | - |  | 56 ± 7 | 49 ± 3 | - | - |
| 0.13 | 98 ± 1 | - | - | - |  | 74 ± 11 | - | - | - |
| 0.25 | 99 ± 1 | - | - | - |  | 62 ± 4 | - | - | - |
| 0.33 | 100 ± 1 | 100 ± 0 | 100 ± 0 | 100 ± 0 |  | 64 ± 7 | 75 ± 2 | 95 ± 1 | 44 ± 9 |
| 0.50 | 100 ± 0 | - | - | - |  | 57 ± 2 | - | - | - |
| 1 | 100 ± 0 | 100 ± 0 | 100 ± 0 | 100 ± 0 |  | 79 ± 3 | 92 ± 1 | 95 ± 1 | 99 ± 1 |
| 2 | 100 ± 0 | - | - | - |  | 79 ± 3 | - | - | - |
| 3 | - | - | - | - |  | 91 ± 2 | 97 ± 1 | 99 ± 0 | 99 ± 0 |
| 6 | - | - | - | - |   | - | - | 97 ± 2 | 100 ± 0 |

aAbbreviations: PPO, protoporphyrinogen oxidase; PRE, preemergence; DAT, days after treatment.

bPalmer amaranth mortality assessments recorded 21 to 28 DAT. Field use rates (1X) included fomesafen at 210 g ai ha-1, flumioxazin at 57 g ai ha-1, oxyfluorfen at 561 g ai ha-1, and trifludimoxazin at 38 g ai ha-1. All experimental runs included a nontreated control for comparison.

**Supplementary Table S4.** Palmer amaranth fresh-weight biomass reductions (%) ± standard error in response to PPO-inhibiting herbicides applied PRE between 2020 and 2022 in Tifton, GA.a,b

|  |  |  |  |
| --- | --- | --- | --- |
| Rate (x) | Susceptible population |   | Suspected resistant population |
| Fomesafen | Flumioxazin | Oxyflurofen | Trifludimoxazin |   | Fomesafen | Flumioxazin | Oxyflurofen | Trifludimoxazin |
| 0.00137 | - | 32 ± 14 | 59 ± 11 | 25 ± 8 |  | - | - | - | - |
| 0.0041 | - | 28 ± 13 | 60 ± 13 | 98 ± 1 |  | - | - | - | - |
| 0.012 | 54 ± 9 | 94 ± 2 | - | - |  | - | - | - | - |
| 0.037 | 86 ± 3 | 100 ± 0 | 99 ± 0 | 100 ± 0 |  | 61 ± 8 | 17 ± 7 | 96 ± 2 | 16 ± 7 |
| 0.11 | 98 ± 1 | 100 ± 0 | - | - |  | 83 ± 4 | 51 ± 5 | - | - |
| 0.13 | 98 ± 2 | - | - | - |  | 87 ± 6 | - | - | - |
| 0.25 | 97 ± 3 | - | - | - |  | 86 ± 7 | - | - | - |
| 0.33 | 100 ± 0 | 100 ± 0 | 100 ± 0 | 100 ± 0 |  | 92 ± 1 | 82 ± 3 | 100 ± 0 | 34 ± 7 |
| 0.50 | 100 ± 0 | - | - | - |  | 73 ± 12 | - | - | - |
| 1 | 100 ± 0 | 100 ± 0 | 100 ± 0 | 100 ± 0 |  | 97 ± 1 | 95 ± 1 | 100 ± 0 | 99 ± 1 |
| 2 | 100 ± 0 | - | - | - |  | 95 ± 2 | - | - | - |
| 3 | - | - | - | - |  | 100 ± 0 | 98 ± 0 | 100 ± 0 | 100 ± 0 |
| 6 | - | - | - | - |   | - | - | 98 ± 1 | 100 ± 0 |

aAbbreviations: PPO, protoporphyrinogen oxidase; PRE, preemergence; DAT, days after treatment.

bPalmer amaranth fresh-weight biomass assessments recorded 21 to 28 DAT. Field use rates (1X) included fomesafen at 210 g ai ha-1, flumioxazin at 57 g ai ha-1, oxyfluorfen at 561 g ai ha-1, and trifludimoxazin at 38 g ai ha-1. All experimental runs included a nontreated control for comparison.