|  |  |  |
| --- | --- | --- |
| **5 cm at time of application** | Fixed effects | Random effects |
| Variable | Estimate | SE | df | t | p | Variable | Variance |
| **Intercept** | **-2.649** | **0.332** | **125** | **-8.0** | **<0.0001** | Replicate | 0.011 |
| **Glyphosate low** | **-3.404** | **0.466** | **119** | **-7.3** | **<0.0001** | Residual | 0.760 |
| **Clethodim low** | **-3.397** | **0.466** | **119** | **-7.3** | **<0.0001** |  |  |
| **Sethoxydim low** | **-2.345** | **0.466** | **119** | **-5.0** | **<0.0001** |  |  |
| **Fluazifop low** | **-3.485** | **0.466** | **119** | **-7.5** | **<0.0001** |   |   |
| **Quizalofop low** | **-3.795** | **0.466** | **119** | **-8.1** | **<0.0001** |   |   |
| **Glyphosate high** | **-3.805** | **0.466** | **119** | **-8.2** | **<0.0001** |  |  |
| **Clethodim high** | **-3.632** | **0.466** | **119** | **-7.8** | **<0.0001** |  |  |
| **Sethoxydim high** | **-3.152** | **0.466** | **119** | **-6.8** | **<0.0001** |  |  |
| **Fluazifop high** | **-3.821** | **0.466** | **119** | **-8.2** | **<0.0001** |  |  |
| **Quizalofop high** | **-3.562** | **0.466** | **119** | **-7.6** | **<0.0001** |  |  |
| **Trial 2** | **1.702** | **0.466** | **119** | **3.7** | **<0.0001** |  |  |
| **Glyphosate low : Trial 2** | **-4.860** | **0.659** | **119** | **-7.4** | **<0.0001** |  |  |
| **Sethoxydim low : Trial 2** | **-4.841** | **0.659** | **119** | **-7.3** | **<0.0001** |  |  |
| **Fluazifop low : Trial 2** | **-4.779** | **0.659** | **119** | **-7.3** | **<0.0001** |  |  |
| **Quizalofop low : Trial 2** | **-4.469** | **0.659** | **119** | **-6.8** | **<0.0001** |  |  |
| **Glyphosate high : Trial 2** | **-3.660** | **0.659** | **119** | **-5.6** | **<0.0001** |  |  |
| **Clethodim high : Trial 2** | **-4.146** | **0.659** | **119** | **-6.3** | **<0.0001** |  |  |
| **Sethoxydim high : Trial 2** | **-5.112** | **0.659** | **119** | **-7.8** | **<0.0001** |  |  |
| **Fluazifop high : Trial 2** | **-4.435** | **0.673** | **119** | **-6.6** | **<0.0001** |  |  |
| **Quizalofop high : Trial 2** | **-4.702** | **0.659** | **119** | **-7.1** | **<0.0001** |  |  |

Table S1: Linear mixed-effects model results assessing log transformed individual biomass (g) for plants that were 5 cm at time of application for Experiment 1. Satterthwaite approximations were used to calculate p values and degrees of freedom (df). Predictors in bold indicate significance (p <0.05). Baseline levels in the intercept are: control plants (no herbicide applications) and trial 1.

|  |  |  |
| --- | --- | --- |
| **8.5 cm at time of application** | Fixed effects | Random effects |
| Variable | Estimate | SE | df | t | p | Variable | Variance |
| **Intercept** | **-2.321** | **0.156** | **132** | **-14.8** | **<0.0001** | Replicate | 0.000 |
| **Glyphosate low** | **-1.143** | **0.221** | **132** | **-5.2** | **<0.0001** | Residual | 0.171 |
| **Clethodim low** | **-1.163** | **0.221** | **132** | **-5.3** | **<0.0001** |  |  |
| **Sethoxydim low** | **-1.361** | **0.221** | **132** | **-6.2** | **<0.0001** |  |  |
| **Fluazifop low** | **-1.955** | **0.221** | **132** | **-8.8** | **<0.0001** |   |   |
| **Quizalofop low** | **-2.112** | **0.221** | **132** | **-9.6** | **<0.0001** |   |   |
| **Glyphosate high** | **-1.571** | **0.221** | **132** | **-7.1** | **<0.0001** |  |  |
| **Clethodim high** | **-1.651** | **0.221** | **132** | **-7.5** | **<0.0001** |  |  |
| **Sethoxydim high** | **-1.835** | **0.221** | **132** | **-8.3** | **<0.0001** |  |  |
| **Fluazifop high** | **-2.138** | **0.221** | **132** | **-9.7** | **<0.0001** |  |  |
| **Quizalofop high** | **-2.207** | **0.221** | **132** | **-10.0** | **<0.0001** |  |  |
| **Trial 2** | **1.125** | **0.221** | **132** | **5.1** | **<0.0001** |  |  |
| Glyphosate low : Trial 2 | -0.032 | 0.313 | 132 | -0.1 | 0.9190 |  |  |
| **Sethoxydim low : Trial 2** | **-1.146** | **0.313** | **132** | **-3.7** | **0.0004** |  |  |
| **Fluazifop low : Trial 2** | **-0.839** | **0.313** | **132** | **-2.7** | **0.0083** |  |  |
| **Quizalofop low : Trial 2** | **-0.958** | **0.313** | **132** | **-3.1** | **0.0027** |  |  |
| Glyphosate high : Trial 2 | -0.277 | 0.313 | 132 | -0.9 | 0.3767 |  |  |
| Clethodim high : Trial 2 | -0.300 | 0.313 | 132 | -1.0 | 0.3392 |  |  |
| Sethoxydim high : Trial 2 | -0.516 | 0.313 | 132 | -1.7 | 0.1013 |  |  |
| **Fluazifop high : Trial 2** | **-0.663** | **0.313** | **132** | **-2.1** | **0.0359** |  |  |
| Quizalofop high : Trial 2 | -0.436 | 0.313 | 132 | -1.4 | 0.1651 |  |  |

Table S2: Linear mixed-effects model results assessing log transformed individual biomass (g) for plants that were 8.5 cm at time of application for Experiment 1. Satterthwaite approximations were used to calculate p values and degrees of freedom (df). Predictors in bold indicate significance (p <0.05). Baseline levels in the intercept are: control plants (no herbicide applications) and trial 1.

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|  |  |  |
| --- | --- | --- |
| **11 cm at time of application** | Fixed effects | Random effects |
| Variable | Estimate | SE | df | t | p | Variable | Variance |
| **Intercept** | **-0.664** | **0.172** | **122** | **-3.9** | **0.0002** | Replicate | 0.009 |
| Glyphosate low | -0.382 | 0.227 | 136 | -1.7 | 0.0949 | Residual | 0.361 |
| **Clethodim low** | **-1.663** | **0.227** | **136** | **-7.3** | **<0.0001** |  |  |
| **Sethoxydim low** | **-0.864** | **0.227** | **136** | **-3.8** | **0.0002** |  |  |
| **Fluazifop low** | **-1.889** | **0.227** | **136** | **-8.3** | **<0.0001** |   |   |
| **Quizalofop low** | **-2.028** | **0.227** | **136** | **-8.9** | **<0.0001** |   |   |
| **Glyphosate high** | **-2.165** | **0.227** | **136** | **-9.5** | **<0.0001** |  |  |
| **Clethodim high** | **-1.631** | **0.227** | **136** | **-7.2** | **<0.0001** |  |  |
| **Sethoxydim high** | **-1.492** | **0.227** | **136** | **-6.6** | **<0.0001** |  |  |
| **Fluazifop high** | **-1.853** | **0.227** | **136** | **-8.2** | **<0.0001** |  |  |
| **Quizalofop high** | **-1.645** | **0.227** | **136** | **-7.2** | **<0.0001** |  |  |
| **Trial 2** | **-0.341** | **0.097** | **136** | **-3.5** | **0.0006** |  |  |

Table S3: Linear mixed-effects model results assessing log transformed individual biomass (g) for plants that were 11 cm at time of application for Experiment 1. Satterthwaite approximations were used to calculate p values and degrees of freedom (df). Predictors in bold indicate significance (p <0.05). Baseline levels in the intercept are: control plants (no herbicide applications) and trial 1.

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|  |  |  |
| --- | --- | --- |
| **15.5 cm at time of application** | Fixed effects | Random effects |
| Variable | Estimate | SE | df | t | p | Variable | Variance |
| **Intercept** | **-0.227** | **0.102** | **142** | **-2.2** | **0.0275** | Replicate | <0.0001 |
| Glyphosate low | -0.035 | 0.138 | 142 | -0.3 | 0.8018 | Residual | 0.130 |
| **Clethodim low** | **-0.638** | **0.138** | **142** | **-4.6** | **<0.0001** |  |  |
| Sethoxydim low | 0.053 | 0.138 | 142 | 0.4 | 0.7003 |  |  |
| **Fluazifop low** | **-0.797** | **0.138** | **142** | **-5.8** | **<0.0001** |   |   |
| **Quizalofop low** | **-0.947** | **0.138** | **142** | **-6.9** | **<0.0001** |   |   |
| **Glyphosate high** | **-0.404** | **0.138** | **142** | **-2.9** | **0.0040** |  |  |
| **Clethodim high** | **-0.700** | **0.138** | **142** | **-5.1** | **<0.0001** |  |  |
| **Sethoxydim high** | **-0.573** | **0.138** | **142** | **-4.2** | **<0.0001** |  |  |
| **Fluazifop high** | **-0.607** | **0.138** | **142** | **-4.4** | **<0.0001** |  |  |
| **Quizalofop high** | **-0.899** | **0.138** | **142** | **-6.5** | **<0.0001** |  |  |
| **Trial 2** | **-0.454** | **0.059** | **142** | **-7.7** | **<0.0001** |  |  |

Table S4: Linear mixed-effects model results assessing log transformed individual biomass (g) for plants that were 15.5 cm at time of application for Experiment 1. Satterthwaite approximations were used to calculate p values and degrees of freedom (df). Predictors in bold indicate significance (p <0.05). Baseline levels in the intercept are: control plants (no herbicide applications) and trial 1.

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|  |  |  |
| --- | --- | --- |
| **17 cm at time of application** | Fixed effects | Random effects |
| Variable | Estimate | SE | df | t | p | Variable | Variance |
| Intercept | -0.043 | 0.096 | 132 | -0.4 | 0.6553 | Replicate | 0.0001 |
| Glyphosate low | 0.141 | 0.136 | 126 | 1.0 | 0.3015 | Residual | 0.0644 |
| **Clethodim low** | **-0.417** | **0.136** | **126** | **-3.1** | **0.0026** |  |  |
| Sethoxydim low | -0.075 | 0.136 | 126 | -0.6 | 0.5808 |  |  |
| **Fluazifop low** | **-0.733** | **0.136** | **126** | **-5.4** | **<0.0001** |   |   |
| **Quizalofop low** | **-0.618** | **0.136** | **126** | **-4.6** | **<0.0001** |   |   |
| Glyphosate high | 0.046 | 0.136 | 126 | 0.3 | 0.7342 |  |  |
| **Clethodim high** | **-0.554** | **0.136** | **126** | **-4.1** | **<0.0001** |  |  |
| **Sethoxydim high** | **-0.551** | **0.136** | **126** | **-4.1** | **<0.0001** |  |  |
| **Fluazifop high** | **-0.903** | **0.136** | **126** | **-6.7** | **<0.0001** |  |  |
| **Quizalofop high** | **-0.749** | **0.136** | **126** | **-5.5** | **<0.0001** |  |  |
| **Trial 2** | **-0.914** | **0.136** | **126** | **-6.7** | **<0.0001** |  |  |
| Glyphosate low : Trial 2 | -0.365 | 0.192 | 126 | -1.9 | 0.0595 |  |  |
| **Sethoxydim low : Trial 2** | **1.501** | **0.192** | **126** | **7.8** | **<0.0001** |  |  |
| **Fluazifop low : Trial 2** | **0.870** | **0.192** | **126** | **4.5** | **<0.0001** |  |  |
| **Quizalofop low : Trial 2** | **1.165** | **0.192** | **126** | **6.1** | **<0.0001** |  |  |
| **Glyphosate high : Trial 2** | **0.464** | **0.192** | **126** | **2.4** | **0.0170** |  |  |
| **Clethodim high : Trial 2** | **0.553** | **0.192** | **126** | **2.9** | **0.0047** |  |  |
| **Sethoxydim high : Trial 2** | **0.884** | **0.192** | **126** | **4.6** | **<0.0001** |  |  |
| **Fluazifop high : Trial 2** | **1.258** | **0.192** | **126** | **6.6** | **<0.0001** |  |  |
| **Quizalofop high : Trial 2** | **1.186** | **0.192** | **126** | **6.2** | **<0.0001** |  |  |

Table S5: Linear mixed-effects model results assessing log transformed individual biomass (g) for plants that were 17 cm at time of application for Experiment 1. Satterthwaite approximations were used to calculate p values and degrees of freedom (df). Predictors in bold indicate significance (p <0.05). Baseline levels in the intercept are: control plants (no herbicide applications) and trial 1.

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|  |  |  |
| --- | --- | --- |
| **Experiment 1** | Fixed effects | Random effects |
| Variable | Estimate | SE | df | t | p | Variable | Variance |
| **Intercept** | **-1.579** | **0.284** | **738** | **-5.6** | **<0.0001** | Replicate | 0.000 |
| **Glyphosate low** | **-4.086** | **0.391** | **738** | **-10.4** | **<0.0001** | Residual | 1.429 |
| **Clethodim low** | **-3.345** | **0.412** | **738** | **-8.1** | **<0.0001** |  |  |
| **Sethoxydim low** | **-3.650** | **0.389** | **738** | **-9.4** | **<0.0001** |  |  |
| **Fluazifop low** | **-4.571** | **0.386** | **738** | **-11.9** | **<0.0001** |   |   |
| **Quizalofop low** | **-4.770** | **0.388** | **738** | **-12.3** | **<0.0001** |   |   |
| **Glyphosate high** | **-4.434** | **0.385** | **738** | **-11.5** | **<0.0001** |  |  |
| **Clethodim high** | **-4.272** | **0.389** | **738** | **-11.0** | **<0.0001** |  |  |
| **Sethoxydim high** | **-4.364** | **0.386** | **738** | **-11.3** | **<0.0001** |  |  |
| **Fluazifop high** | **-4.592** | **0.389** | **738** | **-11.8** | **<0.0001** |  |  |
| **Quizalofop high** | **-4.734** | **0.392** | **738** | **-12.1** | **<0.0001** |  |  |
| **Trial 2** | **-1.965** | **0.174** | **738** | **-11.3** | **<0.0001** |  |  |
| **Number of Leaves** | **0.391** | **0.125** | **738** | **3.1** | **0.0018** |  |  |
| **Glyphosate low : # Leaves** | **1.264** | **0.171** | **738** | **7.4** | **<0.0001** |  |  |
| **Sethoxydim low : # Leaves** | **0.825** | **0.172** | **738** | **4.8** | **<0.0001** |  |  |
| **Fluazifop low : # Leaves** | **1.063** | **0.169** | **738** | **6.3** | **<0.0001** |  |  |
| **Quizalofop low : # Leaves** | **1.087** | **0.166** | **738** | **6.5** | **<0.0001** |  |  |
| **Glyphosate high : # Leaves** | **1.221** | **0.170** | **738** | **7.2** | **<0.0001** |  |  |
| **Clethodim high : # Leaves** | **1.163** | **0.165** | **738** | **7.0** | **<0.0001** |  |  |
| **Sethoxydim high : # Leaves** | **0.987** | **0.166** | **738** | **6.0** | **<0.0001** |  |  |
| **Fluazifop high : # Leaves** | **1.108** | **0.166** | **738** | **6.7** | **<0.0001** |  |  |
| **Quizalofop high : # Leaves** | **1.077** | **0.166** | **738** | **6.5** | **<0.0001** |  |  |
| **Glyphosate low : # Leaves** | **1.173** | **0.170** | **738** | **6.9** | **<0.0001** |  |  |
| **Trial 2 : # Leaves** | **0.808** | **0.074** | **738** | **10.9** | **<0.0001** |  |  |

Table S6: Linear mixed-effects model results assessing log transformed individual biomass (g) for all plants for Experiment 1 using number of leaves at application as the explanatory variable. Satterthwaite approximations were used. Predictors in bold indicate significance (p <0.05). Baseline levels in the intercept are: control plants (no herbicide applications) and trial 1.

|  |  |  |
| --- | --- | --- |
| **Experiment 2** | Fixed effects | Random effects |
| Variable | Estimate | SE | df | t | p | Variable | Variance |
| **Intercept** | **-0.946** | **0.122** | **439** | **-7.7** | **<0.0001** | Replicate | <0.0001 |
| **Glyphosate low** | **-0.793** | **0.166** | **439** | **-4.8** | **<0.0001** | Residual | 0.288 |
| **Clethodim low** | **-1.925** | **0.166** | **439** | **-11.6** | **<0.0001** |  |  |
| **Sethoxydim low** | **-0.975** | **0.166** | **439** | **-5.9** | **<0.0001** |  |  |
| **Fluazifop low** | **-2.035** | **0.166** | **439** | **-12.3** | **<0.0001** |   |   |
| **Quizalofop low** | **-1.862** | **0.166** | **439** | **-11.2** | **<0.0001** |   |   |
| **Glyphosate high** | **-2.168** | **0.166** | **439** | **-13.1** | **<0.0001** |  |  |
| **Clethodim high** | **-1.797** | **0.166** | **439** | **-10.9** | **<0.0001** |  |  |
| **Sethoxydim high** | **-1.329** | **0.166** | **439** | **-8.0** | **<0.0001** |  |  |
| **Fluazifop high** | **-1.954** | **0.166** | **439** | **-11.8** | **<0.0001** |  |  |
| **Quizalofop high** | **-1.574** | **0.166** | **439** | **-9.5** | **<0.0001** |  |  |
| **Disturbed accession** | **0.233** | **0.053** | **439** | **4.4** | **<0.0001** |  |  |
| **Japanese brome** | **0.718** | **0.166** | **439** | **4.3** | **<0.0001** |  |  |
| **Glyphosate low : BRJA** | **-0.823** | **0.234** | **439** | **-3.5** | **<0.0001** |  |  |
| **Clethodim low : BRJA** | **-1.039** | **0.234** | **439** | **-4.4** | **<0.0001** |  |  |
| **Sethoxydim low : BRJA** | **-1.864** | **0.234** | **439** | **-8.0** | **<0.0001** |  |  |
| **Fluazifop low : BRJA** | **-1.159** | **0.234** | **439** | **-5.0** | **<0.0001** |  |  |
| **Quizalofop low : BRJA** | **-1.523** | **0.234** | **439** | **-6.5** | **<0.0001** |  |  |
| **Glyphosate high : BRJA** | **-0.968** | **0.234** | **439** | **-4.1** | **<0.0001** |  |  |
| **Clethodim high : BRJA** | **-1.317** | **0.234** | **439** | **-5.6** | **<0.0001** |  |  |
| **Sethoxydim high : BRJA** | **-1.520** | **0.234** | **439** | **-6.5** | **<0.0001** |  |  |
| **Fluazifop high : BRJA** | **-1.183** | **0.234** | **439** | **-5.1** | **<0.0001** |  |  |
| **Quizalofop high : BRJA** | **-1.561** | **0.234** | **439** | **-6.7** | **<0.0001** |  |  |

Table S7: Linear mixed-effects model results from assessing log transformed individual plant biomass (g) for Experiment 2. Satterthwaite approximations were used. Predictors in bold indicate significance (p <0.05). Baseline levels, contained in the intercept are: control plants (no herbicide applications), undisturbed accession, and cheatgrass. BRJA is Japanese brome.